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# THE CAROTID CIRCULATION IN THE DOMESTIC CAT

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# CAROTID CIRCULATION IN THE DOMESTIC CAT

BY D. DWIGHT DAVIS AND H. ELIZABETH STORY

## INTRODUCTION

Comparative studies on the Carnivora being conducted at Field Museum in connection with work on the giant panda made it desirable to determine the limits of variation in the pattern of the carotid circulation within this group. Tandler's pioneer studies (1899) on the carotid circulation in the Mammalia revealed that there are extraordinary differences in this circulation within the Carnivora, but his limited material and restriction of his work to certain features of the vessel pattern were inadequate to do more than merely suggest the curious history of these vessels in the carnivores.

The cats exhibit an extreme type of carotid specialization, and our attempts to homologize their vessels on the basis of the several existing descriptions for the domestic cat were unsuccessful. In the end it became necessary to dissect a series of injected heads in order to obtain the necessary data. Our dissections revealed such gross inaccuracies and omissions in existing descriptions, particularly in Reighard and Jennings' *Anatomy of the Cat* and Hürlimann's purportedly exhaustive description, that it seems desirable to place our observations on record. Opportunity is also taken to present the relations of these vessels in a series of illustrations, which have hitherto been woefully lacking and without which any description is likely to be unintelligible. The drawings are the work of the junior author.

The material used consisted of seven latex-injected domestic cat heads from the stock of the General Biological Supply House, of Chicago. Our thanks are due that organization, especially Mr. Arnold Blaufuss, for this well-prepared material. Most of the actual dissection was carried out under a 9-power binocular microscope, which made it possible to follow the finest twigs to their destinations when necessary. Professor G. W. Bartelmez, of the University of Chicago School of Medicine, generously supplied a litter of critically important cat fetuses. The lion dissected came from the Lincoln Park Zoo, and the leopards from the Chicago Zoological Society. Dr. Harry Sicher, of the Chicago College of

Dental Surgery, has generously given valuable advice and criticism throughout the course of the study.

Norris (1906) long ago called attention to some of the inconsistencies and inaccuracies in the various descriptions of the carotid arteries in the cat. Later Hürlimann (1912) gave what was obviously intended to be the definitive description of the arteries of the head in the cat. His 72-page paper is a strange combination of painfully meticulous detail and almost incredible blunders; readily accessible vessels are usually described accurately, but most of those requiring careful manipulation must have been dissected very clumsily indeed. Hürlimann's work is further marred by the fact that he employed the confusing terminology of veterinary anatomy. No attempt was made in the latest (1935) "revision" of Reighard and Jennings to correct the extraordinary misstatements that Norris pointed out, or to utilize Hürlimann's work. We agree with Norris that Tandler's description is by far the most accurate, although it is also very incomplete for certain critical regions. Tandler's success in homologizing the vessels may probably be ascribed to the fact that he was engaged in a comparative study; experience has shown repeatedly that descriptions of blood vessels are least reliable when they are based on a single form.

Since the region under consideration is fully and adequately known only in man, and since the only rational nomenclature for mammalian anatomy is the BNA used in human anatomy, the logical procedure seemed to be to attempt a detailed homology of all the branches that have been accorded names in human anatomy. The success that attended this attempt exceeds all expectations, considering the relatively remote relation between man and the carnivores (see tables, pp. 36, 37).

We have made extensive use of our notes and dissections on other carnivores (domestic dog, various procyonids, a civet, black bear, giant panda) in evaluating and interpreting conditions in *Felis*. The literature proves abundantly that dissections of a single form, however complete and carefully made, cannot lead to trustworthy conclusions as to the history of a specialized vessel pattern. The present study amply verifies this conclusion.

Our account of the arteries is not intended to be exhaustive. Many minor muscle ramifications have not been followed out in detail, since they did not seem important in the present connection. Sufficient detail has been included, however, to provide an adequate general picture of the circulation.

## CAROTID CIRCULATION IN THE ADULT CAT

The carotid trunk gives rise to three small vessels from its medial wall at the level of the thyroid cartilage, about 4 mm. behind the point where it is crossed by the hypoglossal nerve. These are the internal carotid, occipital, and ascending pharyngeal arteries (fig. 1). In seven heads (fourteen dissections) the internal carotid invariably came off first and independently, and in all but one of these seven heads a very short common trunk for the occipital and ascending pharyngeal arteries followed after an interval of a millimeter or less. In the seventh head the occipital-pharyngeal trunk was elongated to 8 mm. in length on one side, while on the other the ascending pharyngeal arose from the external carotid 11.5 mm. beyond the internal carotid. According to Tandler all three vessels arise by a common trunk, a condition not observed in any of our material but which would be expected to occur occasionally. Hürlimann, who claims to have dissected ten heads, makes the same statement as Tandler; this cannot be reconciled with our observations.

Two minute muscle twigs, one to the posterior pharyngeal constrictors and one to the sternomastoid and posterior part of the digastric, characteristically arise from the common carotid opposite the origin of the occipital-pharyngeal trunk.

The carotid body is situated at the base of the ascending pharyngeal artery. It is supplied by a twig from the occipital-pharyngeal trunk.

Beyond the origin of these small vessels the carotid trunk continues, practically undiminished in caliber, as the external carotid artery.

### INTERNAL CAROTID CIRCULATION

The occipital and ascending pharyngeal arteries are so intimately related to the internal carotid circulation in the cat that it is convenient to consider these three vessels together. All branches normally arising from the proximal part of the internal carotid have been transferred to the occipital or pharyngeal arteries in the cat, obviously because of the vestigial nature of the internal carotid in this animal.

The ophthalmic artery, which is small as in other carnivores, arises from the anterior part of the circle of Willis, and hence is not directly related to the internal carotid. It accompanies the optic nerve through the optic foramen, lying to the lateral side of the nerve, and terminates in the powerful ciliary artery (p. 22). The

ophthalmic artery is often absent; it was lacking in six out of twelve cases.<sup>1</sup>

#### THE INTERNAL CAROTID ARTERY<sup>2</sup>

*A. carotis interna* is the smallest and most posterior of the three small vessels arising at the bifurcation of the common carotid; there is a small nipple-like expansion of the common carotid at the site of its origin. It is a minute vessel, never containing any injection mass and consequently always white in color, that runs forward to the notch-like carotid foramen situated in the anterior border of the foramen lacerum posterior (fig. 1). It first crosses beneath the vagus nerve to lie immediately mesad of it, and then is situated between the internal carotid nerve (medially) and the vagus and glossopharyngeal nerves (laterally). The vessel lies between the glossopharyngeal and internal carotid nerves as it enters the carotid foramen. It crosses the roof of the medial chamber of the bulla in the carotid canal, accompanied by the internal carotid nerve (fig. 2). The artery and nerve emerge together onto the anterior part of the promontorium, where the artery bifurcates to form two feeble terminal branches. These accompany branches of the nerve onto the promontorium, where they terminate by anastomosing with terminal branches of the next part of the internal carotid, which in the cat has been transferred to the ascending pharyngeal and has reversed the direction of its flow (see p. 12). The internal carotid gives off no branches before reaching the promontorium. The distal (intracranial) part of the internal carotid has been completely taken over by the ascending pharyngeal (see p. 11).

Tandler long ago noted that the internal carotid of the cat was empty in otherwise well-injected specimens. Even latex, which has a much lower viscosity than injection masses previously in use, had failed to enter the internal carotid in any of the specimens we dissected. This led to a suspicion that this usually important artery has degenerated in the cat to a point where it is no longer perforate. Sections were accordingly made through this artery in six cats, at various levels both inside and outside the middle ear.

<sup>1</sup> Hurlimann's description of the ophthalmic is fantastic, with no fewer than three distinct arteries confused as parts of the ophthalmic. He does not mention the true origin of the ophthalmic from the circle of Willis and apparently failed to see it; his "roots" of the ophthalmic are actually the superior hypophyseal arteries. The second part of Hurlimann's ophthalmic actually is the internal ethmoidal, of which what appears to be the orbital part of the true ophthalmic is regarded as a branch.

<sup>2</sup> The "internal carotid" of Reighard and Jennings is the ascending pharyngeal. These authors do not mention the true internal carotid.

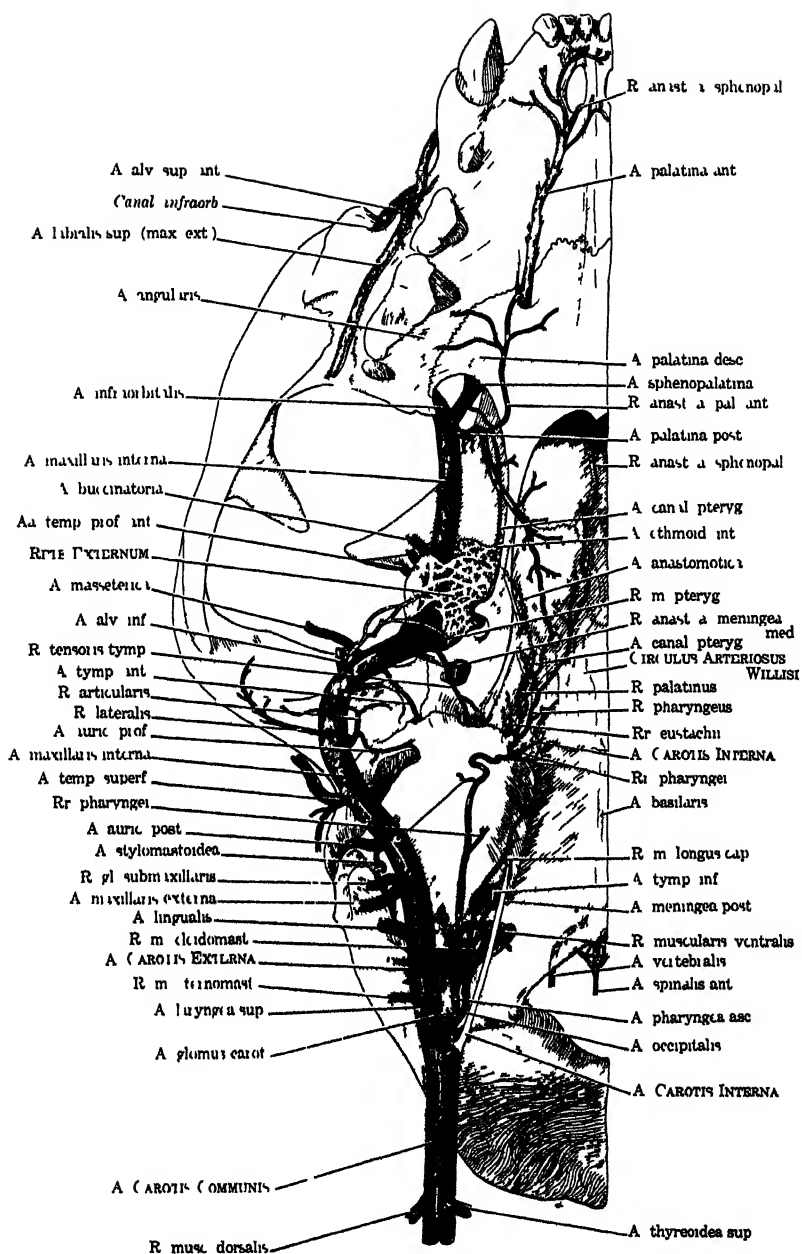


FIG. 1. Ventral view of the arteries of the head in the cat.



These reveal that the artery has a minute lumen, which was crammed with corpuscles, for a short distance beyond its origin. The walls of the vessel are immensely heavy, owing to the thickness of

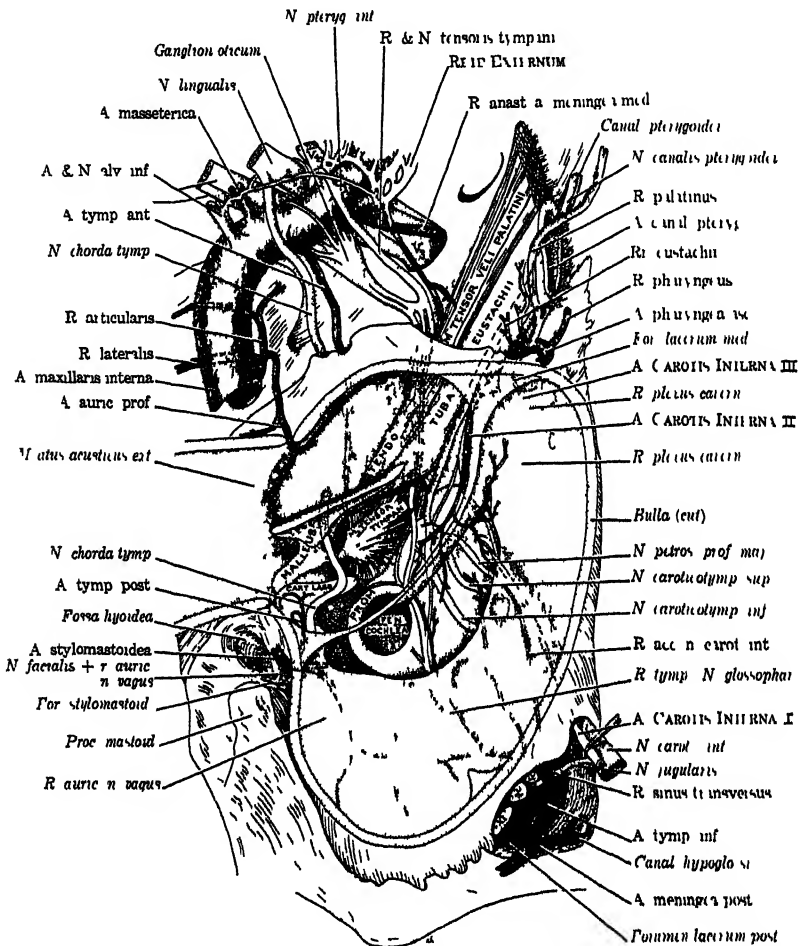


FIG. 2. Arteries of the right auditory region, seen from below. The bulla and external auditory meatus have been opened. The three divisions of the internal carotid are indicated with Roman numerals.

the tunica media; this layer is actually as thick as the media of the external carotid, although the caliber of the latter is enormously greater. Before reaching the carotid foramen the lumen disappears entirely, so that the remainder of the artery is merely an imperforate,

cordlike vestige, apparently made up chiefly of smooth muscle fibers. There is always a nipple-like reduction in the diameter of the artery just before the carotid foramen is reached. The diameter of the vessel varies in different individuals from 0.10 to 0.25 mm.

Thus in the cat the internal carotid is readily divisible into three distinct parts: (1) a posterior imperforate section, extending from the common carotid forward to the promontorium; (2) a middle section, only indirectly related to the first, extending from the promontorium to the foramen lacerum medium, which is functionally a twig of the ascending pharyngeal and in which the direction of blood flow has been reversed; and (3) an anterior (intracranial) section extending from the foramen lacerum medium to the circle of Willis, which has been taken over by the ascending pharyngeal and functionally is the direct continuation of that vessel.

*Variations.*— In addition to the seven cats used for dissection, the internal carotid was examined in four other specimens. In one of these eleven individuals the vessel was perforate on both sides of the head. Sections of the perforate vessel show that its wall is not thickened as in the other cats examined, although the caliber of the artery itself was small (0.20 mm.).

#### THE ASCENDING PHARYNGEAL ARTERY

*A. pharyngea ascendens* arises from the external carotid by a common trunk with the occipital artery, about a millimeter beyond the origin of the internal carotid (fig. 1). The ascending pharyngeal of the cat gives rise only to the anterior (pharyngeal and palatine) branches of the human ascending pharyngeal, the posterior (meningeal and inferior tympanic) branches coming from the occipital artery as in many other carnivores. Three to 5 mm. beyond its origin the ascending pharyngeal gives off a constant large muscle branch (*R. dorsalis* of Hurlimann) that runs anteriorly and medially to the anterior part of the longus capitis; this branch may also supply twigs to the rectus capitis and other muscles of this region.

The ascending pharyngeal pursues a somewhat tortuous course forward along the ventral surface of the bulla, situated between the bulla and the roof of the pharynx, to the foramen lacerum medium. In the cat the foramen lacerum medium is a small canal starting in the antero-medial wall of the eustachian semicanal and leading in a semicircle to its exit within the cranium at the antero-medial tip of the promontorium. The ascending pharyngeal passes through this canal into the sinus cavernosus (figs. 2, 5), to terminate in the

circle of Willis via the anastomotic artery from the external rete (p. 18), so that this part of the vessel *actually represents the distal part of the internal carotid*.

The ascending pharyngeal gives rise to the following branches (figs. 1, 2): (a) *Rr. pharyngei*, arising as it passes over the bulla, supply the anterior and middle constrictor muscles of the pharynx, the anterior end of the longus capitis (often the rectus capitis also), and the pharynx. (b) *R. palatinus* arises near the anterior end of the bulla and continues forward above the eustachian tube to the soft palate, anastomosing with the ascending palatine artery in the vicinity of the tonsil. The fine posterior division of the artery of the pterygoid canal (p. 29) opens into this artery as it crosses the eustachian tube. Just before reaching the foramen lacerum medium, the ascending pharyngeal lies against the medial wall of the eustachian tube for a short distance. Here it gives off several minute (c) *Rr. eustachii* that ramify to the eustachian tube. Immediately before entering the foramen lacerum medium, the ascending pharyngeal gives off a fair-sized twig that accompanies the eustachian tube through the eustachian semi-canal into the lateral chamber of the bulla, where it runs caudad along the septum to ramify over the promontorium. Some of its terminal twigs anastomose with the tympanic arteries on the promontorium, while others pass beneath the septum into the medial chamber of the bulla, where they anastomose with terminal twigs of the proximal part of the internal carotid. This twig is a *vestige of that section of the internal carotid that passed through the tympanic cavity*. This is shown unmistakably by comparison with the corresponding fetal circulation (fig. 8), although the reorganization involved is most extraordinary. Most striking is the complete reversal in the direction of blood flow that must take place late in fetal life; the course taken by the injection mass shows that the blood flows *from* the ascending pharyngeal onto the promontorium in the adult.

*Variations.*—With one exception these were limited to minor variations in the muscle branches. In six heads (twelve dissections) the typical ramifications were very constant; twigs were also supplied to the rectus capitis, digastric, jugulohyoideus, and stylohyoideus in some instances, although none of these muscles was thus supplied in more than 25 per cent of the dissections.

In one head, on one side only, the ascending pharyngeal and ascending palatine arteries anastomosed at the anterior end of the bulla, the resulting trunk entering the foramen lacerum medium.

## THE OCCIPITAL ARTERY

*A. occipitalis* is slightly larger than the ascending pharyngeal and is situated dorsal to it. It immediately arches upward, crossing just outside the posterior cranial nerves that run back from the foramen lacerum posterior (fig. 1). There has at no time been any confusion as to the identity or main course of this vessel, although the important branches arising near its base have been consistently ignored.

Often (in about 50 per cent of the cases) a stout glandular ramus arising near its base and passing back to the large cervical lymph gland is the first branch from the occipital. In seven cases out of twelve a minute twig, arising near this glandular ramus, joined the internal carotid nerve and accompanied it onto the promontorium, where it anastomosed with terminal twigs of the second section of the internal carotid artery; in the remaining five cases this twig arose, near the foramen lacerum posterior, from the posterior branch of the inferior tympanic artery. This vessel thus duplicates the course of the posterior section of the internal carotid artery. Minute twigs to the nodose and superior cervical ganglia, and to the cranial nerves emerging from the posterior lacerated foramen, also arise from the first part of the vessel.

In the space immediately behind the posterior lacerated foramen, which is bounded laterally by the digastric muscle and medially by the ventral axial muscles, the occipital artery gives off three small vessels: (1) a muscular twig that accompanies the spinal accessory nerve to the cleidomastoid muscle and which probably represents the independent sternocleidomastoid artery of human anatomy; (2) a ventral muscle branch (*cervicalis nasalis* of Hürli-mann) to the ventral cervical muscles and the atlanto-occipital articular capsule; and (3) a vessel that bifurcates into a meningeal ramus and the inferior tympanic artery. The main trunk continues laterad across the posterior surface of the mastoid process as the occipital artery proper.

The trunk that gives rise to the meningeal and inferior tympanic arteries passes forward beside the spinal accessory nerve. It bifurcates near the hypoglossal foramen, the larger of the two resulting branches representing the posterior meningeal, the smaller the inferior tympanic (fig. 2). *A. meningea posterior* (condyloidea, Hürli-mann) enters the hypoglossal foramen, through which it reaches the posterior fossa of the skull to ramify to the dura of that fossa. *A. tympanica inferior* (not mentioned by Hürli-mann) continues

forward beside the spinal accessory nerve, to enter the skull at the antero-medial border of the foramen lacerum posterior. Just before entering the skull it divides into two branches that embrace the internal carotid nerve between them as they enter the skull. The more anterior of these branches passes into the transverse sinus, in which it runs around the posterior angle of the petrosal, to enter the periotic through a minute foramen situated about midway along its posterior border. The more posterior of the two branches accompanies the auricular branch of the vagus, crossing the floor of the transverse sinus (i.e. the roof of the bulla), to enter a minute opening in the suture between the bulla and the jugular process of the exoccipital. Continuing with the nerve laterad and anteriorly across the contact surface between the bulla and the exoccipital and mastoid process, it terminates by anastomosing with the posterior branch of the stylomastoid artery. Several twigs arising from the anterior wall of the posterior branch as it crosses the posterior part of the bulla pass forward to the promontorium, where they ramify in the mucous membrane, anastomosing with terminal twigs of the second section of the internal carotid. The largest of these twigs accompanies the tympanic branch of the glossopharyngeal nerve; a somewhat smaller twig, which accompanies the internal carotid nerve to the promontorium, usually arises from the occipital near the origin of that vessel (p. 13), but may come off here. Other twigs arising from the posterior wall of the vessel ramify over the posterior part of the dorsal surface of the bulla.

The main trunk of the occipital artery, beyond the origin of the three branches enumerated above, arches laterad across the mastoid process before ascending between the insertion tendons of the splenius and obliquus capitis anterior muscles. Several twigs pass to the foramen in the mastoid process, and irregular twigs supply the surrounding cervical muscles. At the ventral border of the complexus the artery divides into a superficial and a deep branch. The superficial branch runs between the tendons of the splenius and complexus, to terminate near the external occipital prominence by anastomosing with its fellow of the opposite side. The deep branch runs through the insertion of the rectus capitis posterior complex. Numerous twigs supply the muscles of these respective regions, and others enter the numerous foramina in the occipital bone.

*Variations.*—The occipital artery exhibited few important variations besides those mentioned. In one head there was a digastric twig on one side and a twig to the axial flexors on the opposite side.

## EXTERNAL CAROTID CIRCULATION

In addition to the pharyngeal and occipital branches described above, the external carotid is concerned with the internal carotid circulation only via the internal maxillary artery, and therefore only that artery will be considered here. Thus four main vessels (the lingual, external maxillary, posterior auricular, and superficial temporal arteries), along with several smaller twigs, arising from the external carotid as it arches around the bulla have been omitted.

## THE INTERNAL MAXILLARY ARTERY

*A. maxillaris interna* is the direct continuation of the external carotid beyond the origin of the superficial temporal artery, and is

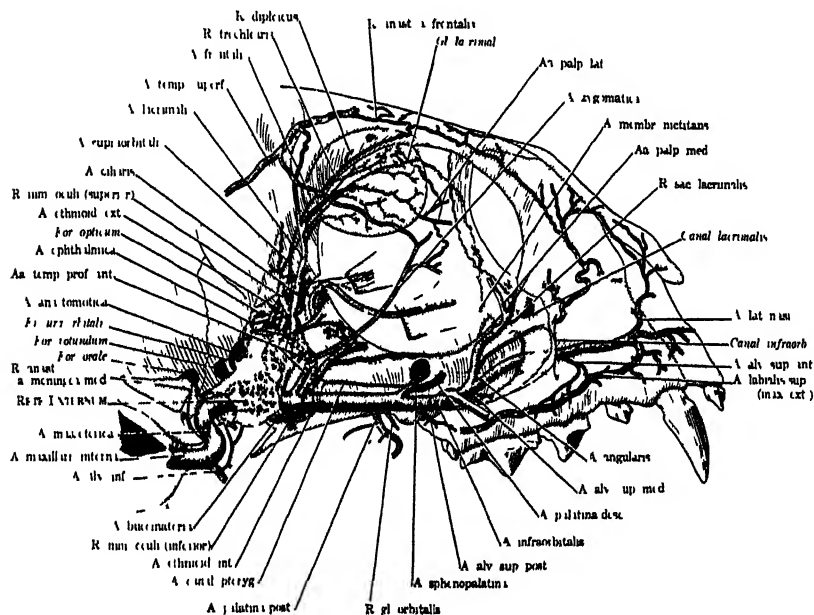


FIG. 3. Right internal maxillary artery and its branches.

by far the largest branch of the external carotid (fig. 1). It arises at the posterior border of the masseter muscle, and passes forward over the postglenoid process, then forms a sharp S-curve around the medial end of the mandibular condyle and forward into the pterygopalatine fossa. Beyond the level of the mandibular articulation it lies on the dorsal surface of the pterygoid muscles, and just anterior to the foramen ovale it is crossed dorsally by the mandibular nerve. Immediately below the foramen rotundum the artery gives

rise to the large external rete (carotid plexus of Reighard and Jennings), from which most of its branches arise (fig. 5).

The branches of the internal maxillary are:

(1) *A. auricularis profunda* (Ramus für das Mandibulargelenk, Hürlimann) arises at the anterior border of the cartilaginous meatus, and immediately bifurcates into medial and lateral branches. The *medial branch* divides again into an articular branch and an auricular branch. The articular branch, which arose independently, anterior to the auricular, in two cases out of eleven, supplies the posterior part of the capsule of the mandibular joint. The auricular branch runs mesad and dorsad in front of the meatus, dividing into two terminal twigs. One of these ramifies to the outer surface of the meatus, while the other perforates the meatus at the juncture of its bony and cartilaginous parts. The latter divides into terminal twigs upon reaching the tympanic membrane; one of these passes downward along the anterior margin of the membrane, while the other passes backward along its upper margin, terminating by following the edge of the manubrium mallei along the tympanic membrane. The *lateral branch* runs laterad across the postglenoid process. It supplies twigs to the posterior part of the mandibular capsule; its terminal twigs run forward into the coronoid fossa where they ramify to the masseter.

(2) *A. alveolaris inferior* arises at the level of the mandibular condyle, and passes dorsad of the internal pterygoid muscle to the mandibular foramen. It is situated laterad of the inferior alveolar nerve as the two enter the foramen. A twig arising from the inferior alveolar near its base supplies the pterygoid muscles by one twig, while a second twig accompanies the lingual nerve. In two cases out of eleven the inferior alveolar and masseteric arteries arose from a common base.

(3) *A. masseterica* arises opposite the inferior alveolar artery and passes up behind the coronoid process of the mandible, where it divides into a masseteric ramus and a posterior deep temporal ramus; the masseteric ramus accompanies the masseteric nerve. *R. massetericus*, which slightly exceeds the posterior deep temporal in caliber, runs outward along the anterior part of the temporo-mandibular joint, supplying a twig to the anterior part of the joint; it terminates in the masseter muscle, where it anastomoses with a masseteric twig from the external maxillary artery. *R. temporalis profundus posterior* ramifies in the lower posterior part of the temporal muscle.

(4) *A. tympanica anterior* arises from the internal maxillary opposite the masseteric artery and about 2 mm. beyond the inferior alveolar (fig. 2). It runs straight caudad to the petrotympanic fissure (in the cat this is a minute opening, usually just mesad of the canal of Hugier for the chorda tympani, in the suture between the sphenoid and the anterior border of the bulla), through which it reaches the lateral chamber of the middle ear. Here it passes back, above the tensor veli palatini, to the tensor tympani, in which it terminates, terminal twigs anastomosing with the R. tensoris tympani (p. 20). Lateral twigs from the anterior tympanic ramify to the lining of the lateral chamber. In two cases out of ten the anterior tympanic took origin from a slender anastomotic loop that connects the inferior alveolar artery with the posterior end of the external rete.

#### THE EXTERNAL RETE

Immediately beyond the origin of the anterior tympanic, the internal maxillary gives rise to the extensive *Rete externum* (figs. 1, 3, 4, 5). This rete is a complex network of fine vessels, interlaced with the vessels of the venous pterygoid plexus, that completely surrounds the trunk of the internal maxillary artery from the foramen rotundum to the level of the optic foramen. Thus the anterior tip of the rete extends forward inside the periorbita. The bulk of the rete lies above and mesad of the trunk of the artery. The rete also surrounds the second branch of the trigeminus, while the third trigeminal branch lies immediately external to it, one of the most posterior roots of the rete usually passing external to the inferior alveolar and lingual branches of this nerve. Fine twigs arising irregularly from the rete pass up into the temporal muscle.

Cross sections were made through the rete and examined under the microscope. These show (fig. 4) a loose plexus of small vessels, about 75 in number on a typical section, associated with the trunk of the internal maxillary artery; the entire plexus is enclosed in a thin sheath of dense connective tissue, and similar sheaths encase the nerves that pass through the rete. The vessels are fairly uniform in caliber, 0.20 to 0.30 mm. in diameter, and there are frequent interanastomoses that give the whole a sponge-like texture. Both the internal maxillary and the vessels of the rete are very thin-walled. The spaces between the vessels represent the associated venous plexus; masses of corpuscles are distributed through them, and under high magnification the venous endothelium forming the outermost layer of the arteries can be distinguished. There appears to be no



connective tissue stroma binding the arteries of the plexus together, although there is a small amount of loose connective tissue between the outermost vessels of the plexus and the sheath that encloses the whole.

The rete of the cat thus belongs to the "network" rather than to the "vascular bundle" (radiating fan) type of retia. It differs notably from any of the retia known from various parts of the body in edentates, lemurs, sirenians, and cetaceans (Wislocki and Straus, 1932; Fawcett, 1942) in the sinus-like arrangement for the venous blood and the associated absence of connective tissue stroma. As pointed out below, it is certainly a secondary development rather than a retention of the primary embryonic vascular network.

(5) *A. anastomotica* (distal rete branches of Hürlimann). Opposite the orbital fissure the antero-medial part of the external rete gives rise to several powerful vessels that pass back through the orbital fissure into the sinus cavernosus, where they unite to form an enormous anastomotic artery that continues posteriorly in the sinus to the level of the dorsum sellae (fig. 5). Here, joined by the much smaller third section of the internal carotid (=ascending pharyngeal), the anastomotic ramus arches sharply anteriorly; at the level of the hypophysis it perforates the dura and passes into the circle of Willis, forming by far the major contribution of blood to that structure. Within the sinus collateral branches of the main anastomotic trunk form a *Rete internum* (Hürlimann's "Rete der Schädelbasis"), much smaller than the external rete, that lies against the semilunar ganglion. Numerous short twigs from the internal rete supply this ganglion. The superior and inferior hypophyseal vessels, which Wislocki (1937) described as coming from the internal carotid, actually arise from this anastomotic artery (fig. 5), although the latter is of course at least in part homologous with the internal carotid of other mammals.

The following branches arise from the trunk of the internal maxillary within the external rete, passing through the rete on the way to their destinations, or take origin from the rete itself:

(6) *A. meningea media* is somewhat modified in the cat from its usual condition in other mammals. An anastomotic vessel arises from the trunk of the internal maxillary immediately beyond the origin of the anterior tympanic, or from the extreme posterior end of the rete itself. This vessel, corresponding in origin to the normal origin of the middle meningeal, runs through the foramen ovale into the middle fossa of the cranium, then arches mesad across the base

of the semilunar ganglion immediately below the ventral end of the tentorium. It terminates on the root of the ganglion by anastomosing with a large loop from the posterior end of the internal plexus (see below). The middle meningeal artery arises as a relatively small branch from the middle of this anastomotic vessel (fig. 5). It ramifies to the dura of the middle fossa in the usual way.

Our specimen of *Nandinia* exhibited a similar anastomotic vessel, except that its medial part (which in this animal opens directly into

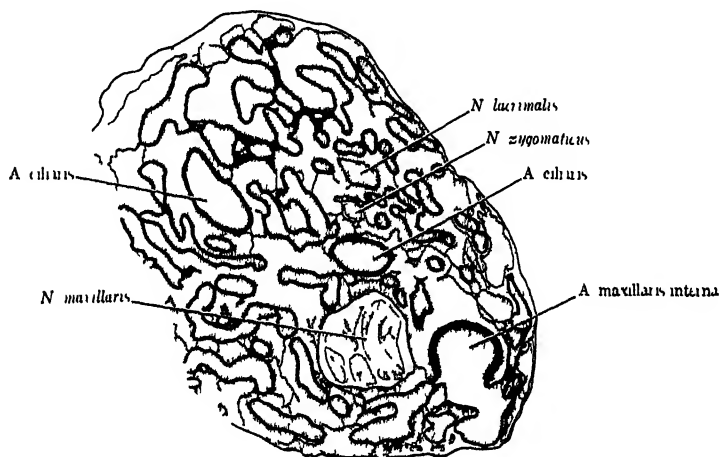


FIG. 4. Semi-diagrammatic cross section approximately through the center of the external rete, to show its sinus-like arrangement. The internal edge of the rete (to the left) has been cut because the large vessels passing into the cranium come off here. Note the absence of connective tissue except immediately beneath the sheath. Arteries are shown in red, veins in blue. Outlines drawn with camera lucida.  $\times 9$ .

the internal carotid) is quite subordinate to the middle meningeal so that the vessel may properly be called "middle meningeal" from its origin. From this it appears (1) that the stout anastomotic loop connecting the internal maxillary and internal carotid via the foramen ovale may characterize ailuroid carnivores, and (2) that in the cat it has increased in caliber, thus functionally taking over the origin of the middle meningeal, as a part of the general diversion of blood from the internal maxillary to the brain.

The superficial petrosal ramus and superior tympanic artery arise from the loop from the posterior end of the internal plexus mentioned above. *R. petrosus superficialis* accompanies the great superficial petrosal nerve into the facial canal, terminating by anastomosing with the stylomastoid artery. *A. tympanica superior*

enters the fissure between the tentorium (parietal) and the petrosal, immediately above the facial canal. Passing to the tympanic cavity through this fissure, it anastomoses with the other tympanic arteries. (The ganglionic twigs to the semilunar ganglion come from the internal rete; see above and fig. 5.)

(7) *Rr. pterygoidei* are several short twigs that arise from the extreme posterior part of the external rete and pass to the internal and external pterygoid muscles.

(8) *R. tensoris tympani* is a slender branch usually arising with the muscle twigs to the pterygoid muscles from the base of the rete (fig. 2); in two cases out of nine it arose from the trunk of the internal maxillary itself. The vessel joins the tensor tympani nerve and accompanies it, passing through the *canalis musculotubarius* above the tensor veli palatini, which it supplies, then below the eustachian tube, to the tensor tympani muscle, in which it terminates. A terminal twig anastomoses with a twig of the anterior tympanic artery.

#### (9) THE ORBITAL ARTERY

(Figs. 3, 5)

The orbital artery and its ramifications in carnivores correspond closely to the ophthalmic circulation of human anatomy, the only essential difference being that in man the main root, from the internal maxillary, has been given up in favor of the ophthalmic root. In the cat the various branches of the orbital artery arise independently from the internal maxillary and the anterior end of the external rete, so that no fewer than seven separate branches are involved. Since this obviously represents a secondary specialization, it seems desirable in the interest of clarity to retain the name "orbital artery" for the complex; individual names would merely mask fundamental homologies.

The ciliary, ethmoidal, deep anterior temporal, lacrimal, frontal, zygomatic, and supraorbital arteries and their branches all belong to the orbital artery circulation. They all arise in the region of the anterior part of the external rete.

(a) *A. ciliaris* (r. bulbi of Hurlimann) is the largest orbital branch of the internal maxillary, arising from its medial wall at about the level of the anterior border of the foramen rotundum. It pursues a tortuous course forward through the external rete, then perforates the external wall of the periorbita near its posterior end to enter the orbit. Within the orbit it passes between the rectus lateralis

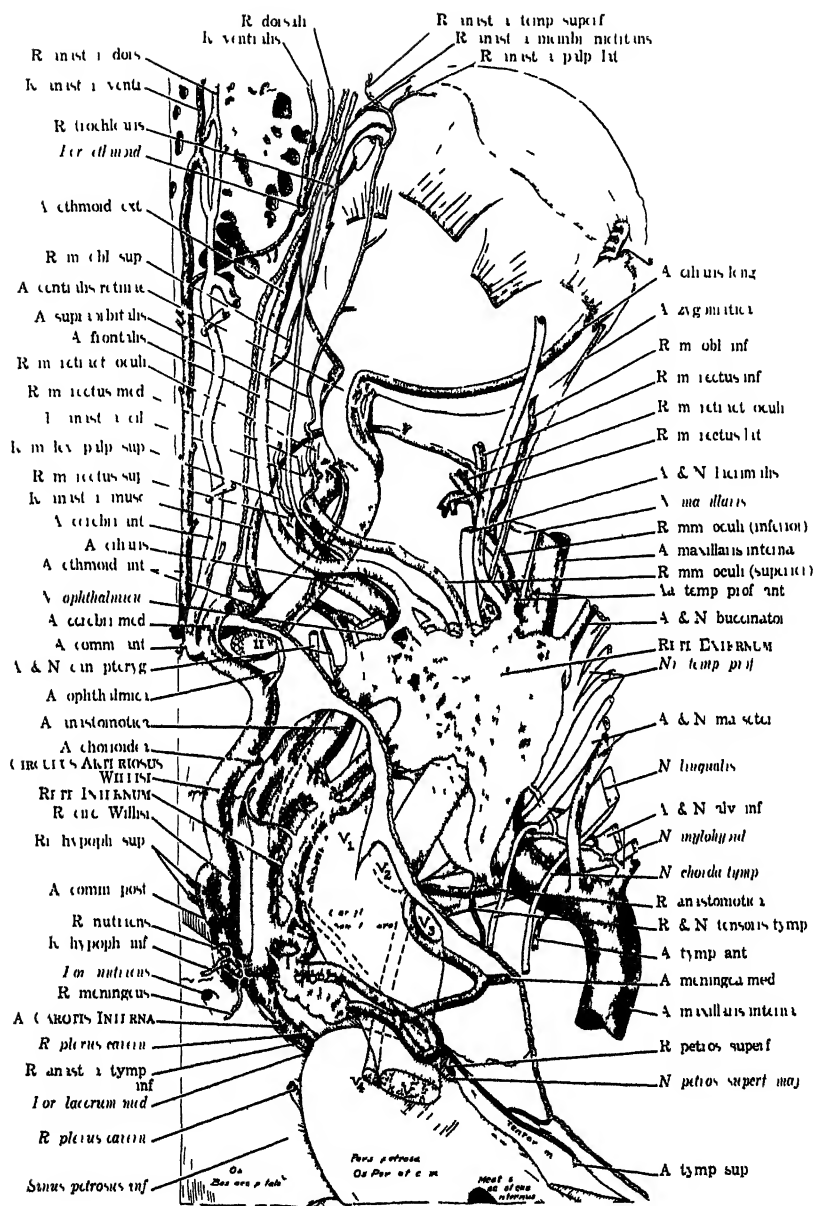


FIG. 5. Arteries of the right basicranium and orbit, viewed from above.

and rectus superior muscles, then between the parts of the retractor oculi, to reach the optic nerve. Here it is reinforced by receiving the slender ophthalmic artery and the terminal twigs of the muscular ramus that corresponds to the "superior set" of human anatomy.

In its course the artery and its terminal branches make a complete spiral revolution around the optic nerve. First crossing above the nerve to its medial side, the ciliary artery receives the ophthalmic and muscle branches mentioned above, then crosses beneath the nerve to its lateral side. Beneath and on the lateral side of the optic nerve the vessel breaks up into its numerous terminal ciliary branches, which interanastomose before entering the eyeball.

*A. centralis retinae* could not be located by gross dissection, even under relatively high magnification. Sections through the optic nerve revealed, however, that a fine, completely occluded vessel enters the nerve about 7 mm. behind the eyeball and continues toward the eye in the substance of the nerve. This vessel, whose lumen is obliterated by thickening of the muscular layer as is the case with the internal carotid, undoubtedly represents a vestige of the central retinal artery.

A stout branch arises from the dorsal wall of the internal maxillary beyond the origin of the ciliary artery. It may easily be traced through the external rete, from which it receives several accessory roots, and within which it divides into the lacrimal artery and one of the deep anterior temporal arteries. (b) *A. lacrimalis* accompanies the lacrimal nerve forward between the superior and lateral rectus muscles to the posterior border of the lacrimal gland, where it breaks up into its terminal branches. One or more of these ramifies exclusively to the lacrimal gland. Another runs across the gland, ramifying twigs to the gland, and terminates at the lateral corner of the eye by breaking up into numerous *Aa. palpebrales laterales*, which ramify over the conjunctiva and anastomose with the medial palpebral arteries in the eyelids. A third branch runs up to anastomose with the superficial temporal artery at the postorbital process. A diploic branch to the frontal sinus, which usually arises from the frontal artery, came from the lacrimal in two out of nine dissections.

(c) *A. temporalis profunda anterior* is represented by two or more separate vessels. One of these is always a branch of the trunk under consideration, while the others arise from the anterior part of the external rete or from the trunk of the internal maxillary. All these vessels ascend in the anterior part of the temporal muscle, which they supply.

(d) *A. zygomatica* is a slender vessel accompanying the zygomatic nerve along the inferior border of the lateral rectus and through the zygomatico-orbital canal. With the nerve it ramifies to the skin at the lateral angle of the eye, anastomosing with the superficial temporal artery. Twigs arising before the vessel passes through the zygomatico-orbital canal supply the periorbita at the lateral corner of the eye, anastomosing with twigs from the lateral palpebral arteries.

(e) *Rr. musculares* are represented partly by a constant large vessel arising from the anterior part of the external rete. It corresponds to the "inferior set" of human anatomy, running between the lateral and inferior recti and supplying those muscles, the inferior oblique, and the retractors.

A vessel arising from the anterior part of the external rete and passing between the lateral and superior recti corresponds to the "superior set" of muscle branches of human anatomy. It gives off twigs to the levator palpebrae, the superior and medial recti, and the retractors; its trunk terminates, near the terminal rete of the ciliary artery, by breaking up into numerous fine twigs that open into the ciliary artery together with the ophthalmic. The twig that supplies the levator palpebrae superioris and rectus superior constantly gives off the extremely slender *A. supraorbitalis* near its base. The supraorbital artery runs forward in the orbital fat along the medial border of the levator palpebrae to the level of the trochlea, supplying twigs to the levator palpebrae and rectus superior on the way. At the trochlea it breaks up into its terminal ramifications. One of these anastomoses with the trochlear ramus of the frontal artery, another with a muscle twig from the external ethmoidal, while several twigs interanastomose with the lateral palpebral artery and the artery to the nictitating membrane.

In one case out of nine the frontal artery took origin from the superior muscle branch.

There is considerable confusion in the literature regarding the ethmoidal arteries of carnivores. All authors have recognized an ethmoidal vessel arising from the internal maxillary and entering the cranium through the ethmoidal foramen. Mivart, Tandler, and Reighard and Jennings mention only this vessel. Others have described in addition an ethmoidal vessel that arises from the external rete and enters the cranium through the optic foramen (Norris, Hürlimann). Ellenberger and Baum (1891, *Anatomie des Hundes*) and Hofmann described a vessel with a similar course and distribution for the dog, but arising from the anterior cerebral artery

instead of entering the cranium through the optic foramen; we have found a similar condition in all carnivores examined except the cats.

Naturally the proper nomenclature for these vessels is contingent upon homology with corresponding human structures. We have carefully followed, in a dog, the course of the ethmoidal nerve and the artery that accompanies it through the ethmoidal foramen. Immediately upon emerging into the olfactory fossa, both nerve

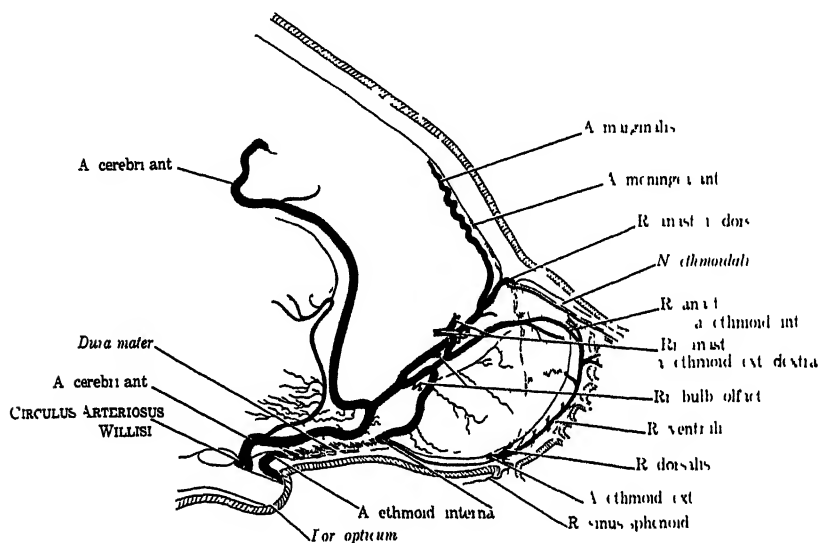


FIG. 6. Distribution of the left ethmoidal arteries. Medial view of anterior part of left forebrain.

and artery give off twigs to the ventral (posterior of human anatomy) ethmoidal cells and to the sphenoidal sinus. Hence there can be no doubt that the artery passing through the ethmoidal foramen in carnivores represents the combined anterior and posterior ethmoidal arteries of man. On the other hand, there appears to be no homologue in man for the ethmoidal artery arising from the anterior cerebral. We propose, therefore, to call the vessel passing through the ethmoidal foramen the *external ethmoidal* artery, and that arising from the anterior cerebral the *internal ethmoidal* artery (fig. 6). The origin of the internal ethmoidal from the external rete (internal maxillary) in the cat is a secondary specialization (see below).

(f) *A. ethmoidalis externa* (ophthalmica externa+ethmoidalis externa of Hürlimann) arises from the antero-dorsal part of the rete as a common trunk with the frontal artery; the trunk gives off the

frontal about 5 mm. before reaching the ethmoidal foramen, then accompanies the ethmoidal nerve forward in a groove in the medial bony wall of the orbit that leads into the ethmoidal foramen. Passing into the olfactory fossa of the cranial cavity, it immediately divides into dorsal and ventral branches. The weaker dorsal branch accompanies the main trunk of the ethmoidal nerve upward in a groove in the lateral wall of the ethmoidal fossa. It gives off numerous twigs to the ethmoidal rete and to the dura covering the olfactory lobe. The dorsal branch terminates by anastomosing with the internal ethmoidal at the postero-dorsal border of the olfactory lobe. *A. meningeae anterior* is a fine twig that arises from this anastomosis and passes back into the anterior chamber of the cerebral fossa, where it ramifies. The ventral branch passes directly into the ethmoidal rete, through which its terminal twigs may be followed antero-dorsally.

Both Tandler and Norris state that the (external) ethmoidal, frontal, and lacrimal arise by a common trunk. We encountered this condition only twice, however, on both sides of one cat out of five (two out of nine dissections).

The *ethmoidal rete* is a loose network of fine vessels situated between the cribriform plate and the olfactory lobe. It is formed by interanastomosis of the terminal twigs of the external and internal ethmoidal arteries, the external making the major contribution. Numerous twigs arising from the rete pass through the cribriform plate into the nasal cavity, while others ramify over the dura covering the olfactory lobes. A fine twig from the ventral part of the rete passes into the sphenoidal sinus.

(g) *A. frontalis* is a slender trunk that accompanies the frontal nerve. Near its base it gives off an *R. trochlearis* that runs in the superior oblique muscle to the trochlea, where it anastomoses with a twig from the artery to the nictitating membrane; the trochlear ramus often arises independently from the external ethmoidal. The main trunk continues with the frontal nerve to the medial angle of the eye, where it pierces the tarsus and ramifies over the frontal area above the eye. Terminal twigs anastomose with frontal twigs from the opposite side, and with terminal twigs of the superficial temporal, angular, and supraorbital arteries.

(h) *A. ethmoidalis interna*<sup>1</sup> (ophthalmica interna [part] of Hürli-mann) arises, by two roots that soon unite, from the antero-internal

<sup>1</sup> In other carnivores the internal ethmoidals arise from the anterior end of the circle of Willis and pass forward along the floor of the cranium to the ethmoidal



end of the external rete and perforates the posterior part of the periorbita. Within the orbit it passes between the superior and lateral recti, then between the parts of the retractor oculi, to come to lie beneath the optic nerve. Twigs arising in this region may supply the lateral and medial recti, and a stout anastomotic branch runs forward to unite with the muscular ramus corresponding to the "inferior" set of human anatomy. Crossing beneath the optic nerve to its medial side, the vessel then passes through the optic foramen lying mesad of the nerve; an anastomotic twig to the ophthalmic artery is often given off at this point. Within the cranial cavity the internal ethmoidal fuses with its mate of the opposite side to form a common median vessel (Hürlimann's meningeal nasalis), that runs forward in the dura on the floor of the cranium. At the posterior end of the olfactory fossa it arches upward in the fissure between the olfactory lobes. Here, situated in the falx olfactorii near the posterior boundary of the olfactory lobes, it interanastomoses freely with the anterior branch of the anterior cerebral artery, while ventrally several twigs run forward to the ventral part of the ethmoidal rete. Numerous twigs are given off to the falx olfactorii, and others pierce the falx to ramify over the medial surfaces of the olfactory lobes. The vessel terminates by anastomosing with both branches of the external ethmoidal in the dorsal part of the ethmoidal rete. A much-contorted unpaired vessel, to which both the anterior branch of the anterior cerebral and the internal ethmoidal contribute, passes back above the longitudinal fissure of the cerebrum, situated in the dura over the superior sagittal sinus; this is the *A. marginalis* of Hofmann.

A strong anastomotic loop, which is usually present when the ophthalmic is absent, may pass from the anterior part of the circle of Willis to the internal ethmoidal just before the latter unites with its fellow. This condition occurred on one side only in each of two cats.

#### TERMINAL BRANCHES OF THE INTERNAL MAXILLARY

(Fig. 8)

Beyond the external rete the internal maxillary artery accompanies the maxillary division of the trigeminal nerve forward across

rete. Occasionally the pair of arteries unites to form a common median artery. Consequently, in all but the circulation from which it arises, the internal ethmoidal of the cat agrees with that of other carnivores, and it is of interest to note that accessory origin from the circle of Willis appears occasionally in the cat (see below). Transfer of the origin of this vessel to the internal maxillary in the cat is probably associated with the general shift of vessel origins to an extra-cranial position in the Felidae. Unfortunately it was not convenient to examine this vessel in *Nandinia*, our only civet.

the dorsal surface of the external pterygoid muscle, terminating just beyond the anterior border of the muscle by dividing into the infra-orbital and a common trunk for the descending palatine and sphenopalatine arteries. This part of the vessel gives rise to the following branches:

(10) *A. buccinatoria* arises from the ventral wall of the trunk of the internal maxillary in the anterior part of the external rete. Its origin is thus topographically associated with the origin of the separate units of the orbital artery in the cat, but it is known from the condition in other carnivores that the buccinator artery is not to be regarded as a part of the orbital artery. The vessel accompanies the buccinator nerve forward and downward to the buccinator muscle, crossing the anterior border of the coronoid process of the mandible. Good-sized twigs are supplied to the temporal and masseter muscles as the vessel crosses them, and to the orbital gland as the vessel passes beneath it. It anastomoses with the external maxillary and infraorbital arteries. No anastomosis with the transverse facial, with which this vessel also unites in man, could be found, a condition probably correlated with the reduced size of the transverse facial in carnivores.

(11) *A. palatina posterior* (palatina minor of Hürlimann) arises a short distance before the terminal bifurcation of the internal maxillary. It accompanies the nerve of the same name forward over the internal pterygoid muscle, to which it supplies twigs, to a point immediately behind the pharyngeal notch in the posterior border of the palatine. Arching backward and inward immediately behind this notch, it passes back in the substance of the palatine glands, which are situated in the soft palate between the pterygoid processes, to terminate near the posterior end of the soft palate by anastomosing with the ascending palatine artery and the palatine branch of the ascending pharyngeal. Numerous twigs to structures in the soft palate greatly reduce its caliber as it passes back. Near its origin the posterior palatine gives off a slender anastomotic ramus that runs forward over the ventral surface of the hard palate to anastomose with the anterior palatine artery.

(12) *R. glandularis*, to the orbital gland, is a small vessel or pair of vessels arising beside the posterior palatine artery. In one instance the glandular ramus came from the posterior palatine itself.

At the level of the pharyngeal notch the internal maxillary terminates by dividing into two main trunks, a lateral external

trunk distributed to structures on the side of the face, and a medial internal trunk distributed to the nose and palate.

(13) *A. infraorbitalis*, the more lateral of the two terminal trunks of the internal maxillary, accompanies the infraorbital nerve to the infraorbital foramen. Passing through this foramen onto the lateral surface of the nose, it ramifies extensively in this region. *A. alveolaris superior posterior* arises from the infraorbital near its base, and breaks up into numerous twigs that enter the foramina in the alveolar prominence over the last (fourth) premolar and first molar teeth. *A. alveolaris superior media*, somewhat larger than the posterior superior alveolar, comes off about 7 mm. behind the posterior border of the infraorbital canal and enters a foramen at the posterior border of the canal (i.e. above the third premolar). *A. angularis* (*A. malaris* of Hürlimann), which in man arises from the external maxillary, in the cat is a large vessel arising from the infraorbital artery just behind the infraorbital foramen. It passes forward immediately below the eyeball, but outside the periorbital, to the anterior (medial) corner of the eye. Here the vessel bifurcates, one twig passing above, the other below, the lacrimal sac and medial palpebral ligament. These twigs, the medial palpebral arteries, continue along the upper and lower eyelids, respectively, forming a superior and an inferior tarsal arch with the lateral palpebral arteries. Near its base the angular artery gives off a branch that passes out through the infraorbital canal, one terminal twig joining the infraorbital artery in supplying the vibrissae, while a second (*A. dorsalis nasi* of Hürlimann) runs up over the side of the nose to anastomose with the lateral nasal, frontal, and infraorbital arteries. A second branch of the angular arising about 4 mm. farther distad pierces the periorbital and runs beneath the eyeball to supply the inferior oblique and medial rectus muscles and the nictitating membrane and gland, terminating by anastomosing with the supra-orbital artery and the trochlear branch of the frontal. A third and much smaller branch of the angular, arising just before its terminal bifurcation into the medial palpebral arteries, supplies the lacrimal sac.

The main trunk of the infraorbital artery continues through the infraorbital canal onto the side of the face, where it is distributed to the upper lip, the vibrissae and the structures associated with them, and the side of the nose. It anastomoses with the superior labial artery. Numerous *Aa. alveolares superiores anteriores* enter the minute foramina over the first two premolars, the canine, and

the incisors. *A. lateralis nasi* arises from the infraorbital over the canine tooth and ramifies over the side of the nose, anastomosing with a terminal branch of the angular artery.

The more medial of the two terminal branches of the internal maxillary gives rise to three vessels. The slender artery of the pterygoid canal arises near its base, and slightly beyond this the trunk divides into the descending palatine and sphenopalatine arteries.

(14) *A. canalis pterygoidei* (fig. 1).—The artery of this name in man is represented by two separate divisions in the cat. The more anterior division is a slender anastomotic vessel extending from the common trunk of the descending palatine and sphenopalatine arteries back to the external rete. It arises at the terminal bifurcation of the trunk, then passes back successively beneath the sphenopalatine vein and the sphenopalatine ganglion, joining the nerve of the pterygoid canal at the posterior border of the ganglion and accompanying it back across the internal pterygoid muscle to the external rete, in which it terminates near the orbital fissure. The posterior division of the artery is represented by a slender vessel arising from the rete immediately behind the termination of the foregoing one. It promptly joins the nerve of the pterygoid canal, continuing with it in the pterygoid groove across the basisphenoid bone to the dorso-medial border of the eustachian tube. There the artery anastomoses with the palatine branch of the ascending pharyngeal.

The artery of the pterygoid canal is a threadlike vessel in the cat, and gives rise to no branches. The structures it supplies in man (roof of pharynx, eustachian tube, tympanum) are all supplied by the ascending pharyngeal in the cat.

(15) *A. palatina descendens* (palatina major of Hürlimann), which is smaller than the sphenopalatine artery, accompanies the anterior palatine branches of the sphenopalatine ganglion through the pharyngeal (pterygopalatine) canal, emerging on the palate through the posterior palatine foramen. Immediately upon reaching the palate, the vessel gives off a slender anastomotic branch (representing the anterior part of the minor palatine of human anatomy?) that runs back to anastomose with the posterior palatine artery.

The main trunk takes the name *A. palatina anterior* beyond the posterior palatine foramen. It runs forward on the hard palate, still accompanying the anterior palatine nerves, to the incisive (anterior palatine) foramen, where it anastomoses with the sphenopalatine artery.

(16) *A. sphenopalatina* accompanies the nasopalatine branch of the sphenopalatine ganglion. It enters the nose through the large sphenopalatine foramen, and arches up over the mucoperiosteum of the inferior nasal meatus to the nasal septum, along which it runs forward to the incisive foramen.

Immediately upon entering the nose, the sphenopalatine artery gives off a posterior lateral nasal artery to the lateral chamber of the nose. Just before reaching the nasal septum a posterior branch is given off that passes back over the roof of the nasopharynx to anastomose with the ascending pharyngeal artery. Posterior septal arteries arising as the vessel courses along the septum ramify over the septum, anastomosing with the ethmoidal arteries. The anterior terminal branches anastomose with the anterior palatine artery and the artery of the nasal septum (from the superior labial) at the incisive foramen.

#### CIRCLE OF WILLIS

The architecture of the circle of Willis is affected to some extent by the radical alterations in the artery patterns of the head. The circle is elongate, and is sharply divided into a powerful anterior half and a correspondingly weaker posterior half. Most of the blood is carried to the circle by the common trunk formed by the large anastomotic branches from the external carotid, which pass into the cranium via the orbital fissure; the ascending pharyngeal (= original anterior end of the internal carotid) adds a relatively small contribution to this trunk as the trunk passes the posterior border of the hypophysis, and the middle meningeal also contributes to it via the internal rete. The basilar artery, which enters the posterior end of the circle in the usual way, is also considerably weaker than the anastomotic trunk.

As it enters the circle, the anastomotic trunk divides into a posterior branch (corresponding to the *A. communicans posterior* of human anatomy) and a larger anterior branch that arches forward around the optic chiasma to divide into the middle and anterior cerebral arteries far forward in front of the chiasma. The choroid and ophthalmic arteries arise from the anterior branch before it divides into the cerebral arteries.

*A. communicans anterior* is extremely variable, but is not absent as stated by Hürlimann. It was not symmetrical in any one of the six brains examined (fig. 7). In only one brain was there anything resembling a typical communication between the two anterior

cerebral arteries; in this case numerous thread-like twigs to the anterior perforated substance arose directly from the anterior cerebrals. In the other five cases a large vessel arose from one anterior cerebral and passed forward in the longitudinal sulcus of the brain, supplying twigs to the olfactory areas bordering the sulcus; in two of these a minute twig arising from the opposite anterior cerebral joined the much larger vessel, thus completing the communication, but in the remaining three brains the minute twig was absent so



FIG. 7. Variations in the anterior communicating artery, showing different manners of origin of the vessel (situated between the two anterior cerebrals) that supplies the anterior perforated substance.

that there was no communication at the usual site, although fine twigs arising from both anterior cerebrals farther forward inter-anastomosed.

### CAROTID CIRCULATION IN THE KITTEN AND THE FETUS

It seemed likely that occlusion of the internal carotid takes place relatively late during ontogeny in the cat, since the adult condition of the artery is reminiscent of the adult condition of the umbilical artery and ductus arteriosus in man. In an effort to verify this the internal carotid was examined in a kitten 23 days old. Sections of the vessel from this animal revealed that it was already completely occluded, and that the structure of the wall was similar to that of the adult.

On the other hand, dissection of the auditory region of fetuses measuring 80 mm. in crown-rump length supplied critical information on the morphogenesis of the carotid circulation (fig. 8). Three specimens of this litter were dissected under a binocular microscope; they yielded uniform results. The caliber of the internal carotid is more than half that of the external carotid, a relation that compares very favorably with that of "normal" carnivores. The internal carotid is perforate throughout its length, but it is extremely interesting that there is always a constriction in the vessel as it passes through the foramen lacerum posterior. After passing across the promontorium, it receives the *much smaller* ascending pharyngeal

near the anterior end of the bulla, then passes into the cranium through the foramen lacerum medium. The anastomotic ramus from the internal maxillary artery, which unites with the internal carotid as in the adult, exceeds the carotid only slightly in caliber. The

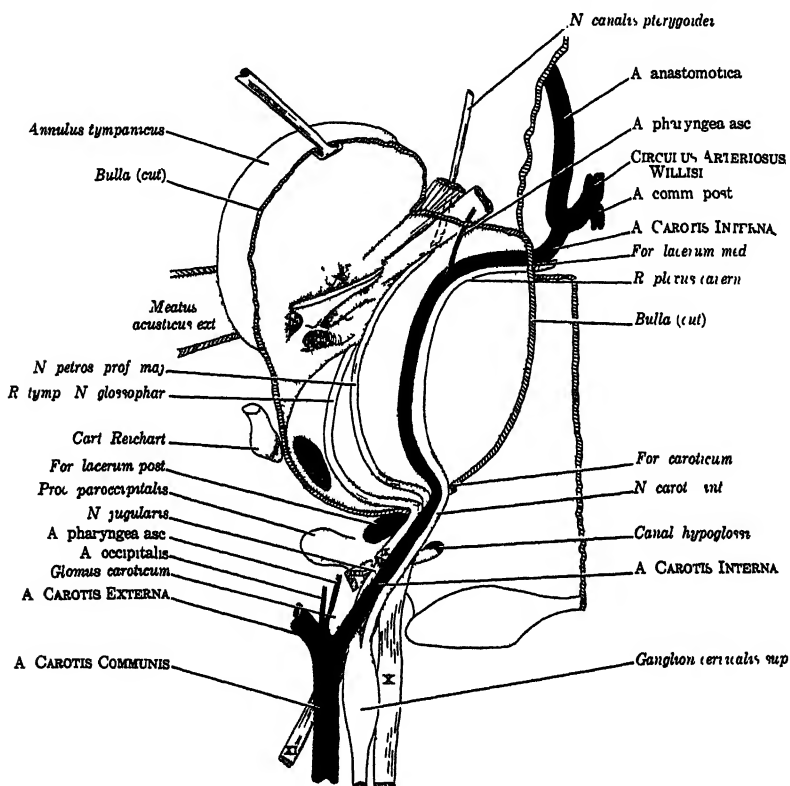


FIG. 8. Course of the right internal carotid in a fetal cat of 80 mm. C.R. length, semi-diagrammatic. The bulla has been opened and the annulus tympanicus pulled aside.

external rete is well developed, as might have been expected from Tandler's work on the pig.

The petrosal seems well ossified at this stage, but the bulla is thin, membranous, and apparently unossified; the septum bullae could not be detected by gross dissection. The bulla is also much less extensive than in the adult; nowhere does it extend beyond the periphery of the promontory. Thus the inflation that characterizes the medial chamber of the bulla in the adult must be the result of subsequent expansion, and this means that a segment of the internal

carotid between the foramen lacerum posterior and the promontorium would be squeezed between the petrosal and the dorsal wall of the expanding bulla. In the adult this part of the artery is situated in a deep groove in the bulla (entotympanic); there is no corresponding furrow in the opposing surface of the petrosal.

## CAROTID CIRCULATION IN THE LION AND THE LEOPARD

The lion (*Panthera leo*) and the leopard (*Panthera pardus*), along with the other large cats, are generally regarded as quite distinct from the smaller cats of the genus *Felis*. Hence it is of interest to compare the carotid circulation of these animals with that of the domestic cat. Tandler described the carotid circulation in the tiger (*P. tigris*), leopard (*P. pardus*), and ocelot (*Felis pardalis*), but his descriptions of the vessels around the auditory region, particularly of the important relations around the foramen lacerum medium, are incomplete. We had available the heads of an adult lioness, an adult leopard, and a juvenile leopard, all from local zoos. The lion and the adult leopard at our disposal had been shot through the head, but fortunately this did not seriously interfere with complete dissection of the vessels around the bulla. The juvenile leopard was an excellent injected specimen. The general carotid pattern in these animals, as Tandler originally pointed out, is practically identical with that of the domestic cat. The internal carotid is proportionately even smaller; it measured only 0.25 to 0.30 mm. in diameter near its origin in the two adults, which is barely outside the range for the domestic cat. In spite of its minute size, however, this vessel seems to be less degenerate than in the cat. It was perforate, at least for some distance beyond its origin, in the lion and juvenile leopard, but appeared to be occluded in the adult leopard. The muscular layer (tunica media) also seems to be of normal thickness, in contrast to the cat. Tandler's description for the leopard indicates that the internal carotid was not completely occluded in his specimen; his description for the tiger is not clear for this point.

There is an extensive rete surrounding the orbital part of the internal maxillary, as in the cat, and a large anastomotic vessel passing through the orbital fissure supplies most of the blood to the circle of Willis.

The most important and consistent differences from the domestic cat are found in the auditory region, and involve the internal carotid



and ascending pharyngeal arteries. In all three specimens the internal carotid passes through the middle ear in the normal way, continuing into the cranium via the foramen lacerum medium and terminating in the anastomotic branch that supplies the circle of Willis. This contrasts sharply with the adult domestic cat, where the internal carotid is subordinated to the ascending pharyngeal beyond the foramen lacerum medium. On the other hand, it is strikingly similar to the fetal condition in the domestic cat, and is not dissimilar (except in the greatly reduced caliber of the internal carotid) to the normal carnivore condition.

The origin of the ascending pharyngeal artery differs from the domestic cat on both sides in all three specimens of *Panthera*. It takes origin independently of the occipital artery and much farther distad, beyond the origin of the lingual artery. In both the lion and the leopard the vessel runs anteriorly over the ventral surface of the bulla toward the foramen lacerum medium, but instead of the main trunk passing through the foramen and thence to the circle of Willis as it does in the domestic cat, it terminates in the usual pharyngeal branches. Only a minute, threadlike anastomotic twig passes into the foramen, where it opens into the internal carotid.

On the basis of available evidence, therefore, the carotid circulation in the larger cats of the genus *Panthera* is less specialized in the area around the bulla than in *Felis domestica*, but in general exhibits the characteristic felid stamp. Our data, added to those of Tandler, indicate that the internal carotid may be perforate more frequently than it is in *Felis*, but too few specimens have been examined to permit safe generalization on this point.

## DISCUSSION

The chief objects of this study were: (a) to determine the degree to which the carotid circulation of the cat may be homologized with that of man, particularly in the interest of accurate nomenclature; (b) to determine the exact nature of the peculiar specializations to which the carnivore carotid circulation has been subjected in the cat; and (c) to determine, if possible, the cause for these specializations.

Tandler supplied the first key to this puzzle when he pointed out the important diversion of blood to the brain via the anastomotic vessel that connects the internal maxillary with the circle of Willis. Other similar but less spectacular re-routings of blood to the impoverished brain circulation have hitherto been ignored.

## HOMOLOGIES WITH MAN

The accompanying table shows, more clearly than description can, the close similarity between the vessel patterns in man and the cat, a similarity that extends even to minor branches in almost every instance except where mere muscle twigs are involved. Indeed, it may be noted that differences between these two patterns involve, almost exclusively, a sort of "reshuffling" of larger trunks, with the terminal twigs affected to a much less degree or not at all.

A feature not brought out in the table, but which was repeatedly noted during this and other studies, is that interanastomoses between the terminal twigs of two or more trunks constitute one of the most constant features of a given vessel pattern. Parent trunks may wax or dwindle with variation in the number or importance of the twigs to which they give rise, as is the case with the ophthalmic artery. The trunks can shift their topographical relations with other trunks of the same system; they may interchange or recombine their terminal ramifications; and finally, two or more trunks may unite throughout all or a part of their lengths to form a common vessel, or a single vessel may break up into a number of separate entities. The terminal twigs, on the other hand, maintain a high degree of uniformity in their relations to each other and to the final structures that they supply. In general, detailed correspondence between the same vessel system in two remotely related forms (within the Mammalia) becomes increasingly close as we progress from major trunks<sup>1</sup> toward peripheral twigs. This fact, which is in complete accord with what is known of the ontogeny of vessel patterns, where trunks arise as local condensations in a primitive capillary plexus, does not appear to have been emphasized heretofore. Its importance from the standpoint of comparative angiology is apparent, since emphasis has hitherto been placed almost exclusively on the more individually variable main trunks. On the other hand, new pathways may sometimes be "superimposed" on the basic pattern, masking that pattern to a greater or lesser extent, as is beautifully illustrated in the carotid circulation of the domestic cat.

The carotid circulation of the cat presents three vessels not found in the corresponding circulation of man. The important anastomotic branch (p. 18) of the internal maxillary is discussed below. The orbital artery (p. 20), which corresponds closely with the human ophthalmic circulation, is of general occurrence in non-primate

<sup>1</sup> Exclusive, of course, of the actual conducting vessels: aorta, carotids, subclavians, iliacs, etc.

*Homo*

The carotid circulation in man and the domestic cat compared. The lists of vessels are not complete, only those branches of interest in the present connection having been included. The vessels are arranged in the order in which they come off, from posterior to anterior.

A. carotis communis	A. carotis interna	A. caroticotympanica [absent in <i>Felis</i> ]	
		A. ophthalmica	<ul style="list-style-type: none"> <li>A. centralis retinae</li> <li>A. lacrimalis</li> <li>Aa. palpebrales lat.</li> <li>Rr. musculares</li> <li>A. ciliaris</li> <li>A. supraorbitalis</li> <li>A. ethmoidalis posterior</li> <li>A. ethmoidalis anterior</li> <li>A. meningea anterior</li> <li>Aa. palpebrales med.</li> <li>A. frontalis</li> <li>A. dorsalis nasi [absent in <i>Felis</i>]</li> </ul>
	A. carotis externa	A. thyreoidea superior	
		A. pharyngea asc.	<ul style="list-style-type: none"> <li>Rr. pharyngei</li> <li>R. palatinus</li> <li>Rr. eustachii</li> <li>A. tympanica inferior</li> <li>A. meningea posterior</li> </ul>
		A. lingualis	
		A. maxillaris externa	..... (A. angularis)
		A. sternocleidomastoidea	
		A. occipitalis...	<ul style="list-style-type: none"> <li>R. mastoideus</li> <li>R. auricularis</li> <li>Rr. musculares</li> <li>Rr. meningei</li> <li>Rr. occipitales</li> </ul>
		A. auricularis post.	
		A. temporalis superficialis	
		A. maxillaris interna	<ul style="list-style-type: none"> <li>A. auricularis profunda</li> <li>A. tympanica anterior</li> <li>A. alveolaris inferior</li> <li>A. meningea media</li> <li>A. masseterica</li> <li>A. temporalis prof. post.</li> <li>A. temporalis prof. ant.</li> <li>Rr. pterygoidei</li> <li>A. buccinatoria</li> <li>A. alveolaris sup. post.</li> <li>A. infraorbitalis.....</li> <li>A. palatina descendens</li> <li>A. canalis pterygoidei</li> <li>A. sphenopalatina</li> </ul>
			<ul style="list-style-type: none"> <li>A. alveolaris sup. ant.</li> <li>Rr. nasales</li> <li>A. palatina major</li> <li>Aa. palatinae minores</li> </ul>

*Felis domestica*

Vessels marked with a dagger (†) have no homologues in man.

A. carotis communis	A. thyreoidea superior	
	A. carotis interna [vestigial posterior section only; ophthalmic from circle of Willis]	
	A. pharyngea asc.	Rr. pharyngei
		R. palatinus
	A. occipitalis	Rr. eustachii
		A. carotis interna [middle and anterior sections]
	A. occipitalis	†R. accompanying N. caroticus internus
		Rr. musculares
		R. cleidomastoideus
		A. meningea posterior
	R. sternomastoideus	
	A. lingualis	
	A. maxillaris externa	
	A. auricularis posterior	
	A. temporalis superficialis	
A. carotis communis	A. carotis externa . .	A. auricularis profunda
		A. alveolaris inferior
	A. carotis externa . .	A. masseterica . .
		{ R. massetericus
		{ R. temporalis prof. post.
	A. maxillaris interna . . . .	A. tympanica anterior
		†A. anastomotica
	A. maxillaris interna . . . .	A. meningea media
		Rr. pterygoidei
	A. maxillaris interna . . . .	A. ciliaris
		A. centralis retinae
A. carotis communis	A. maxillaris interna . . . .	A. lacrimalis
		Aa. palpebrales lat.
	A. maxillaris interna . . . .	Aa. temporales prof. ant.
		†A. zygomatica
	A. maxillaris interna . . . .	Rr. musculares
		A. supraorbitalis
	A. maxillaris interna . . . .	A. ethmoidalis externa
		{ = ant. + post. of man
	A. maxillaris interna . . . .	A. meningea anterior
		A. frontalis
A. carotis communis	A. maxillaris interna . . . .	†A. ethmoidalis interna
		A. buccinatoria
	A. maxillaris interna . . . .	A. palatina post. [ = minor ]
		†R. gland. orbitalis
	A. maxillaris interna . . . .	A. alveolaris sup. post.
		†A. alveolaris sup. med.
	A. maxillaris interna . . . .	A. angularis
		Aa. palpebrales med.
	A. maxillaris interna . . . .	Aa. alveolares sup. ant.
		Rr. nasales
A. carotis communis	A. canalis pterygoidei	
	A. palatina	
	descendens . . . . A. palatina ant. [ = major ]	
	A. sphenopalatina	

mammals, and hence requires no further comment. The branch to the orbital gland (p. 27) is either absent entirely in man, or is so inconsequential that it is not mentioned in text-books. This obviously is correlated with the vestigial nature of the orbital gland in man.

On the other hand, the caroticotympanic artery of human anatomy is not represented in the cat. That this is a secondary specialization in the cat is shown by the fact that a typical caroticotympanic is present in other carnivores (e.g. *Ursus*).

### *Felis* COMPARED WITH OTHER CARNIVORES

Having established the identity of the individual elements of the carotid circulation in the cat, we may now attempt to determine the alterations to which the basic carnivore pattern has been subjected in this animal. Tandler dissected the arteries of the head in twelve species of Carnivora. His series, which represents a fair cross section of the order, has been supplemented and extended by numerous partial and several complete dissections made by us. On the basis of these data the main outlines of the primitive carnivore circulation, and at least the major morphological trends that it exhibits in this group, can be sketched with certainty. Those important to an understanding of the specializations found in the cat may be considered categorically.

(1) *The internal carotid is always smaller than the external carotid.* This is probably a very general primitive condition among mammals, and hence would be of no interest here were it not for the fact that very definite trends can be traced among the Carnivora. The artery is well developed in the arctoids (dogs, raccoons, pandas, and bears), where its caliber is about half that of the external carotid. It is also well developed in the Mustelidae. In *Viverra zibetha* among the civets, Tandler described the internal carotid as "considerably weaker" than the external carotid, and it was a relatively slender vessel (about equal to the ascending pharyngeal) in our specimen of *Nandinia*. Finally, in the hyenas and cats the internal carotid is essentially a non-functional vestige. Thus the internal carotid of the ailuroid carnivores appears to present a picture of progressive degeneration, which reaches its final stage in the domestic cat.

(2) *An anastomotic ramus, passing into the cranial cavity through the orbital fissure, connects the internal maxillary artery with the internal carotid.* This is a simple straight vessel of fair caliber in the raccoons and mustelids (it was absent on both sides of the head

in a specimen of *Mustela putorius*). In the dogs it forms one or more sharp kinks along its course. In *Viverra* and *Nandinia* it exhibits a simple but definite retiform structure in its intracranial part, while the hyenas and cats present the enormous rete already described, which involves not only both the intracranial and extracranial parts of the anastomotic ramus, but also a section of the internal maxillary. On the other hand, the anastomotic vessel is absent entirely in the bears and the giant panda (*Ailuropoda*), and these animals therefore represent an opposite trend.

This anastomotic vessel does not appear to be of general occurrence among mammals, since Tandler apparently found it only in a few rodents outside the Carnivora. It probably originally evolved, for reasons unknown, by simple hypertrophy of the nutrient twigs supplying the cranial nerves that exit through the orbital fissure, since these vessels arise from both the circle of Willis and the internal maxillary, and thus would furnish a connection between these two circulations via interanastomosis of their fine terminal twigs. In the Carnivora the anastomotic vessel then presents two opposite evolutionary trends: in the direction of complete suppression in the Arctoidea, and toward extraordinary elaboration in the Aeluroidea. It is noteworthy that the caliber and complexity of this vessel vary inversely with degeneration of the internal carotid.

(3) *An anastomosis passing across the dorsal surface of the semi-lunar ganglion connects the anastomotic ramus (2) with the middle meningeal.* This is a thread-like vessel in *Bassariscus* and *Procyon*. It is almost as large as the trunk of the middle meningeal in the Viverridae (*Nandinia*). In *Felis domestica* it exceeds the middle meningeal in caliber, so that the meningeal appears to arise from the anastomotic vessel; in this final condition the anastomosis assumes the form of a vessel connecting the internal maxillary with the internal carotid circulation via the foramen ovale. It thus has the same function in the cat as does the anastomotic ramus described under (2), namely, diversion of blood from the internal maxillary to the impoverished internal carotid circulation; and is another instance of the remodeling of an arrangement existing in primitive carnivores to a new and wholly different end.

The anastomosis was entirely absent in the bear and giant panda, so that these animals again exhibit an opposite trend from the remaining Carnivora.

(4) *An anastomotic vessel, passing through the foramen lacerum medium, connects the ascending pharyngeal artery with the internal*

*carotid*. This anastomosis has not been noted heretofore, and we have checked it only on *Canis*, *Bassariscus*, *Procyon*, *Ailuropoda*, *Ursus* [*Euarctos*], *Mustela*, and *Nandinia* in addition to *Felis* and *Panthera*. In all these animals except *Felis domestica* the anastomotic vessel is a relatively minor terminal twig of the ascending pharyngeal, the bulk of the ascending pharyngeal supplying pharyngeal structures in the usual way. In the domestic cat, on the other hand, the anastomotic twig is hypertrophied to such an extent that the pharyngeal branches are minor accessory twigs by comparison. In the cat the main trunk continues via the foramen lacerum medium to the circle of Willis; the intracranial part of this vessel obviously represents the distal end of the internal carotid, but the line of demarcation between ascending pharyngeal and internal carotid is no longer determinable in the cat. This, like the specializations considered under (2) and (3), is obviously an arrangement for diverting blood into the internal carotid circulation in the cat. It is surprising that the larger cats (*Panthera*) show no suggestion of the hypertrophy found in *Felis*.

The bears and giant panda again exhibit an entirely different direction of morphological evolution. In them the foramen lacerum medium either is covered with fibrous tissue or is often obliterated entirely. In our black bear a small vessel, probably representing a vestige of the anastomotic artery, ran from the ascending pharyngeal through this tissue; our giant panda had the foramen entirely obliterated, and appeared to lack any vestige of the anastomotic artery.

(5) A "pharyngeotympanic" branch of the ascending pharyngeal artery enters the middle ear via the eustachian semicanal, anastomosing with the caroticotympanic on the promontorium. This vessel, which apparently is homologous with the unnamed tympanic twig of the Vidian artery of human anatomy, is one of the main vessels supplying the middle ear in many carnivores. It was present in all arctoid carnivores examined, and invariably considerably exceeded the caroticotympanic (which ramifies to the same region) in caliber. In the civets and cats, on the other hand, both the caroticotympanic and "pharyngeotympanic" circulations are considerably altered. There is no vessel in *Nandinia*, *Panthera*, or *Felis* that can be certainly homologized with the caroticotympanic artery, and in *Nandinia* and *Felis* there is nothing corresponding to the pharyngeotympanic. In *Panthera* several minute twigs arise from the ascending pharyngeal and pass through the eustachian semicanal

onto the promontorium; these resemble the pharyngeotympanic artery of other carnivores.

Thus it appears that in the Carnivora the posterior parts of the external and internal carotid circulations, from the bifurcation of the common carotid forward to the orbital fissure, form potentially collateral circulations. Because of the anastomotic vessel that inter-connects them via the orbital fissure, either vessel could take over the terminal part of the other with a resulting reciprocal variation in the caliber of the trunks of the two vessels. In the cat this reciprocal variation has been carried to one extreme, with the internal carotid vestigial and non-functional and the external carotid correspondingly increased in caliber. The reverse of this, the internal carotid assuming complete dominance at the expense of the external carotid, probably could not reach a correspondingly extreme stage because of the important vessels arising from the posterior part of the external carotid.

The cervical and petrosal parts of the internal carotid and the ascending pharyngeal artery, because of the anastomotic twig that inter-connects them at the foramen lacerum medium, also form a pair of collateral trunks similar to the external-internal carotid pair. Reciprocal variation between these two trunks is also theoretically possible in either direction, with the condition in the cat representing one of the two possible extremes.

Thus the basic alterations in the carotid circulation of the cat are all designed to divert blood from the external carotid (extra-cranial in position) to the brain. From the functional standpoint there are two possible causes: suppression of the internal carotid *demanded* that blood be supplied to the brain from some other source, and the external carotid was the only other possible source; or establishment of the collateral blood supply to the brain *permitted* degeneration of the internal carotid.

#### CAUSES FOR THE CAROTID SPECIALIZATIONS IN *Felis*

Naturally there is a strong temptation to speculate as to causes for the extraordinary specializations found in the cat. Tandler examined several possible explanations, such as a mechanical obstacle resulting from inflation of the bulla, or that large vessels supplying a powerful facial region may have taken over the blood supply to the brain as a mechanical advantage, but he dismissed them as untenable for what he regarded as "obvious reasons."

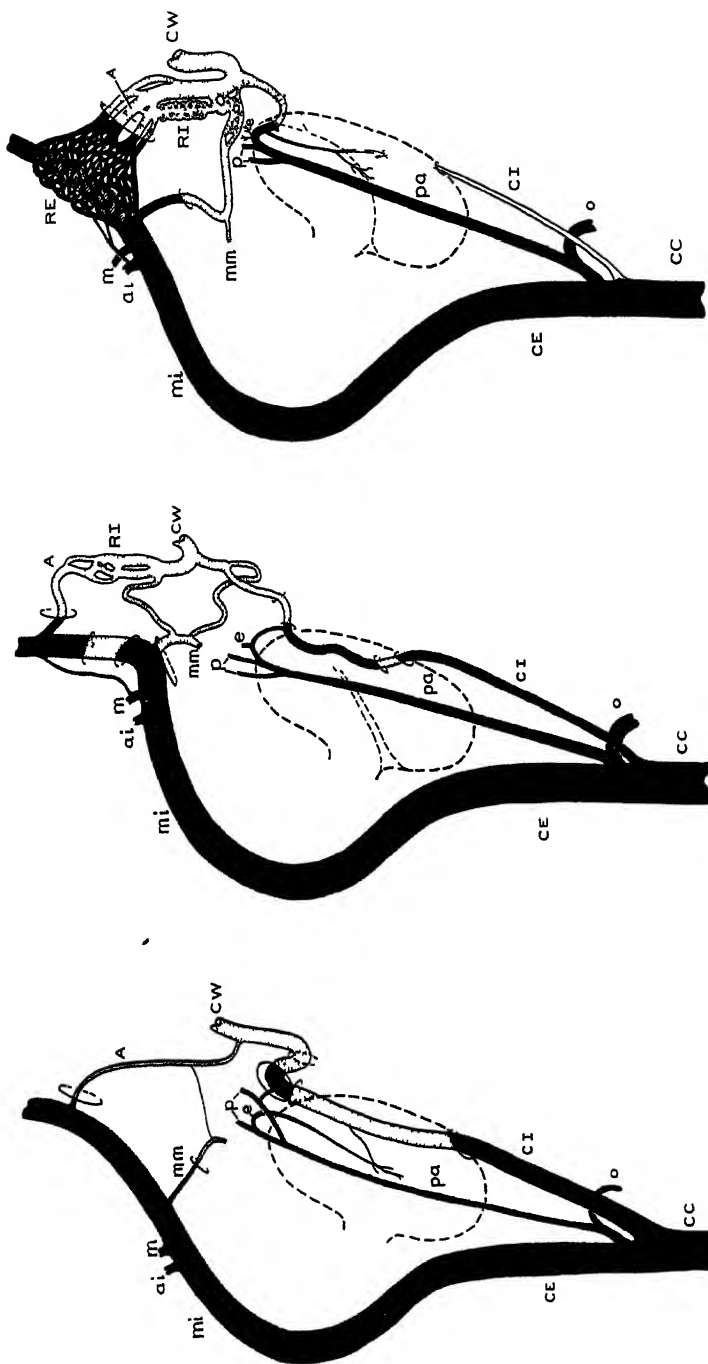


The cats are by no means unique in the suppression of the internal carotid. This vessel is also known to be vestigial in many artiodactyls and in *Cavia* among the rodents, and it is of further interest that in these animals a rete mirabile, similar to that found in the cat, is situated between the internal maxillary and the circle of Willis. This appears to be more confusing than helpful in explaining the condition, however. The artiodactyls, the acme of herbivorous specialization, represent almost the ideal functional antithesis of the cats, which exhibit the highest degree of carnivorous specialization among living mammals.

Tandler (1906) studied the ontogeny of the corresponding rete mirabile in the pig. He was able to establish definitely that it does not represent a retention of the primary embryonic vessel network, as had been suggested, but arises later from the internal carotid itself after that artery is well developed, and therefore is a "secondary" formation. This, of course, is an important point from the functional standpoint, since it indicates that the rete is produced wholly by some unknown hydrodynamic factor arising within the parent vessel and not by influences exerted from outside the vessel. We have seen also that the internal carotid functions almost until birth in the cat, not reaching a condition of complete degeneration until immediately before or after birth.

We have seen, furthermore, that the condition of the carotid circulation in the cats merely represents the end-stage of a trend in the Carnivora, and that conditions in certain other carnivore families represent morphologically intermediate stages. A large carotid canal is present in the relatively primitive Oligocene felid *Dinictis*. These facts show that the specialization did not arise suddenly and *de novo* in the cats, and hence that it is probably to be regarded as a mechanical *advantage* rather than a mechanical *necessity*. The parallel between the postulated history of this region in the phylogeny of the cats and its ontogenetic history is almost complete.

Of greatest interest, however, is the fact that the starting points for all the felid specializations are present in the most unspecialized carnivore pattern (fig. 9). In other words, the new pathways that characterize the cat are merely the culmination of a basic trend common to all carnivores except the secondarily specialized bears and giant panda. Thus the cause for the carotid specialization in *Felis* probably should not be sought in the cats themselves (where Tandler was seeking it), but in those carnivores that exhibit the *beginnings* of the specialization (e.g. *Bassariscus*). The same hydrodynamic



*Bassariscus astutus*

*Nandinia binotata*

*Felis domestica*

FIG. 9. Diagram to show the transition from the carotid circulation of a primitive carnivore (*Bassariscus*) to that of *Felis domestica*. The intermediate position occupied by the viverrid *Nandina* is obvious. Stippled parts are intracranial or run through canals; the outline of the bulla is indicated in broken lines. *A*, *A.* anastomotica; *ai*, *A.* alveolaris inferior; *CC*, *A.* carotis communis; *CE*, *A.* carotis externa; *CI*, *A.* carotis interna; *CW*, *Circulus arteriosus Willisii*; *e*, *R.* eustachii; *m*, *A.* masseterica; *mi*, *A.* maxillaris interna; *mm*, *A.* meningea media; *o*, *A.* occipitalis; *p*, *R.* pharyngei; *pa*, *A.* pharyngea ascendens; *RE*, *Rete externum*; *RI*, *Rete internum*.

or mechanical factors that led to the definitive condition in the cat must have been responsible for the first step taken by the carnivores in this direction. The spectacular rete development seen in the hyenas and cats is certainly entirely secondary, and its significance represents a separate problem.

In the present state of our knowledge we cannot answer the question as to why the carotid circulation of the carnivores evolved in the direction it did.

### SUMMARY

(1) The carotid circulation of the domestic cat is extraordinarily specialized, even in comparison with most other carnivores. Nevertheless it can be homologized, almost without exception, with the named ramifications of the carotid circulation of man.

(a) Differences between man and the domestic cat involve chiefly a reshuffling of major trunks, on the one hand, and differences in their relative calibers on the other. The terminal branches are usually involved to a lesser extent or not at all.

(b) This suggests that, within the Mammalia, interanastomoses between the terminal twigs of two or more trunks may be the most constant features of a given vessel pattern. Thus the undue attention that has been devoted to the more conspicuous but more variable main trunks has probably contributed to the reputation for erratic variability that has impeded comparative angiology.

(2) All existing descriptions of the carotid circulation of the cat, except Tandler's, contain numerous gross errors. Tandler's description, *because it is part of a comparative study*, is accurate as far as it goes, although it is very incomplete.

(3) From the functional standpoint the most conspicuous features are the suppression of the internal carotid and the far-reaching readjustments that have resulted.

(a) The internal carotid proper is vestigial, its proximal part reduced to an imperforate connective tissue strand.

(1) the section through the carotid canal is completely vestigial and non-functional

(2) the section in the lateral chamber of the bulla has reversed its direction of flow—blood flows posteriorly, from the ascending pharyngeal, to supply the promontorium

- (3) the section anterior to the foramen lacerum medium has been entirely taken over by the ascending pharyngeal.
- (b) The brain, normally supplied almost entirely by the internal carotid, receives its blood from the external carotid via three novel vessels:
  - (1) an enormous anastomotic vessel connecting the internal maxillary with the circle of Willis via the orbital fissure
  - (2) an anastomotic vessel connecting the internal maxillary with the circle of Willis via the foramen ovale (part of the original middle meningeal artery)
  - (3) the trunk of the ascending pharyngeal having completely taken over the distal part of internal carotid, with its pharyngeal ramifications of very secondary importance.
- (c) There are two retia mirabilia in connection with the anastomotic vessel through the orbital fissure; these are secondary developments, and are probably of secondary hydrodynamic importance:
  - (1) an extensive extra-cranial rete surrounding the internal maxillary at the origin of the anastomotic vessel; the structure of this rete differs radically from any hitherto known from mammals
  - (2) a smaller intra-cranial rete associated with the anastomotic vessel in the sinus cavernosus.
- (d) The internal ethmoidal artery arises extra-cranially, from the internal maxillary, instead of from the circle of Willis as in the Arctoidea. The condition in the Hyaenidae and Viveridae is unknown.
- (e) The orbital artery of other carnivores is represented in the cat by seven independent trunks, apparently a secondary result of the formation of the external rete.
- (f) The ophthalmic artery, when present, arises from the anterior part of the circle of Willis. It was absent in 50 per cent (six out of twelve) of the cases.
- (g) The internal carotid degenerates very late in ontogeny (near parturition).
- (4) All the important adaptations found in the domestic cat are present in some form in all carnivores except the bears and giant

panda; the latter appear to exhibit an entirely different morphological trend.

- (a) The three anastomoses listed under 3b are present in *Bassariscus* in the form of thread-like vessels. These vessels presumably arose from nutrient twigs to surrounding structures, and are not known to occur in non-carnivores.
- (b) In the Viverridae the caliber of the internal carotid is much reduced, and the caliber of the three anastomotic vessels is increased proportionately. There are also incipient retia mirabilia. Thus the condition in the Viverridae is almost exactly intermediate between the primitive pattern of *Bassariscus* and the highly specialized pattern of *Felis domestica*.
- (c) The large cats (*Panthera*) resemble *Felis* closely, but are slightly less extreme: the minute internal carotid is often (usually?) perforate, and the distal end of the ascending pharyngeal resembles that of non-felid carnivores.
- (d) The pattern of the Hyaenidae is known only from Tandler's incomplete description, but as far as known agrees with that of the Felidae.

(5) Thus the Carnivora may be arranged in a closely graded series leading from the least aberrant pattern (*Bassariscus*), which differs little from that of other mammals, to the extremely specialized pattern of *Felis domestica*. The transition thus exhibited agrees closely with the changes that take place in the pattern during ontogeny in *Felis*.

(6) Therefore the cause for the carotid specialization in *Felis* is probably to be sought in such a form as *Bassariscus*, rather than in the highly specialized *Felis* itself.

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# ON THE CLASSIFICATION OF THE HISTERID BEETLES

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# ON THE CLASSIFICATION OF THE HISTERID BEETLES

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In the summer of 1941, Field Museum acquired the Charles A. Ballou collection of histerid beetles. This collection, including numerous types, and with a world-wide representation of this interesting family, is a most important addition to the Museum's research material. Represented in it are many undescribed species; some of these are described herein,<sup>1</sup> together with others from the collections of the United States National Museum, the Museum of Comparative Zoology, the American Museum of Natural History, Carnegie Museum, Dr. Edward S. Ross, Mr. William Spector, and the author. Perhaps the richest lots involved were a small collection of Costa Rican histerids sent to Mr. Ballou by the late Ferdinand Nevermann and a similar lot acquired by the United States National Museum with the Nevermann collection.

Acknowledgment is due the individuals and the officials of the institutions mentioned above for their kind co-operation in making material available for study.

As a result of some experience in dealing with the higher categories of the coleopterous family Histeridae, it has become evident to me that the classification of the family as proposed by Bickhardt (1916, 1917), largely following Marseul and Lacordaire, is replete with untenable generic assignments and subfamilial and tribal definitions. Some of these errors are excusable; others may be laid to a complete lack of appreciation of convergent evolution and a lack of perspective and balance in "weighting" the relative value of particular structural characters; some are the result of careless observation. A painstaking morphological study is necessary before one can attempt a revisional and more satisfactory classification and definition of some of the subfamilies. However, a few of the more obvious changes necessary can be noted at this time, and it is desirable that this be done in order to clarify certain generic assignments made in this paper.

<sup>1</sup> Certain portions of these more or less fragmentary studies were originally undertaken as more comprehensive revisions, the completion of which must be postponed.

The Histeridae may be divided into two great and apparently natural groups on the basis of the presence or absence of a prosternal lobe. For convenience it might be well to distinguish them as follows:

- A prosternal lobe not present. . . . . Division I. Saprinomorphae.  
A prosternal lobe present. . . . . Division II. Histeromorphae.

The saprinomorph subfamilies are rather well-defined assemblages, but the histeromorphs need considerable study and probably redivision. The Chlamydopsini, a tribe of Hetaerinae erected by Bickhardt (l.c.) lack a prosternal lobe, and in genital structure bear no apparent relationship with the Hetaeriomorphini or Hetaerini; they are here included with the saprinomorphs as a distinct subfamily. They are the only saprinomorphs in which the prosternal alae<sup>1</sup> close the antennal cavities from below, the cavities being situated in the anterior prothoracic angles.

#### KEY TO THE SUBFAMILIES OF THE SAPRINOMORPHAE

1. Antennal cavities closed beneath by the prosternal alae, situated in the anterior prothoracic angles; antennal scape strongly angulate and usually greatly expanded, the club greatly elongated, at least three times as long as broad. . . . .  
*Chlamydopsinae*  
Antennal cavities, if present, open beneath; antennal scape normal, the club usually a little, but never three times, longer than broad . . . . . 2
2. Form round, oval, or oblong oval . . . . . 3  
Form cylindrical, sometimes stoutly so . . . . . 4
3. Antennal cavities situated in front of the procoxae, next to and nearly always encroaching upon the prosternal keel; dorsal elytral striae rarely absent, if so, then at least a sutural stria is present; lateral, longitudinal pronotal grooves never present. . . . .*Saprininae*  
Antennal cavities situated in the anterior prothoracic angles, or in front of the procoxae (laterally or at middle); if they rarely do lie next to the keel, then they do not encroach upon it, and lateral, longitudinal grooves are present on the pronotum; dorsal elytral striae never present though rather vague impressions may be. . . . .*Abraeinae* (in part)
4. Antennae inserted "on the front," the fossae cutting into the margin of the front medial to the eyes. . . . .*Abraeinae* (Terebrinae)  
Antennae inserted under the margin of the front, anterior to the eyes . . . . 5
5. Head produced anteriorly into two horns of variable length; mandibles deflexed, moving in a plane at right angles to the long axis of the head. . . . .*Nipontinae*  
Head not produced into two horns, though it may be produced as a long pointed rostrum in the female; mandibles moving in the same plane as the long axis of the head. . . . . 6

<sup>1</sup> The writer here uses the term *ala* (plural *alae*) to refer to the arms or expansions that extend laterally from the anterior region of the prosternal keel to unite with the hypomera. The procoxal cavities are in large part bounded by them anteriorly.

6. Head horizontal in repose; antennae consisting of eight segments and a club; anterior margin of prosternal alae at most with only a very slight notch, antennal cavities not defined . . . . . *Trypanaeinae*  
 Head vertical in repose; antennae consisting of seven segments and a club; anterior margins of prosternal alae with rather deep longitudinal incisions for the reception of the antennal funicle in repose . . . . . *Trypeticinae*

#### KEY TO THE SUBFAMILIES OF THE HISTEROMORPHAE

1. Antennal scape normal, neither expanded nor strongly angulate . . . . . 2  
 Antennal scape expanded and strongly angulate . . . . . *Hetaerinae*  
 2. Labrum with setigerous punctures . . . . . 3  
 Labrum without setigerous punctures . . . . . *Histerinae*  
 3. Antennal cavities completely open, usually situated just anterior to the procoxae at middle of hypomera; prosternal alae deeply and longitudinally incised for the reception of the antennal funicle in repose; protibiae oligodenticulate . . . . . *Dendrophilinae*  
 Antennal cavities situated in the anterior prothoracic angles, at least partly closed beneath by the prosternal alae; protibiae multidenticulate . . . . . *Tribalinae*

As outlined here, the Histerinae include the Hololeptinae of other authors. The latter seem to be very closely related to the Platysomini and would seem best placed next to them as a separate tribe. The tribe Tribalini of Bickhardt has been given subfamily rank.

#### Subfamily Abraeinae

Unfortunately, many of the workers who have published studies on the minute members of this subfamily have been handicapped by a lack of adequate optical and lighting equipment. Many of the species have distinctive characters which can be observed only with rather high magnifications. In drawing up the following descriptions and keys, the writer has used magnifications of from 100 to 150 diameters; occasionally magnifications of about 200 diameters have been used to check certain characters. Accordingly, the terms applying to density and coarseness of punctures are to a considerable extent relative to the magnifications used. Specimens must be well cleaned and in the majority of cases can be identified only if the sternal disks are kept free for examination. Instead of gluing the beetles directly to cardboard triangles, it is convenient to glue them to a short length of bristle or human hair, one end of which has been attached to the end of a short triangle. A very small drop of dark shellac serves as an excellent adhesive and the tip of the bristle should be applied to the elytral flank or the elevated metasternal sides of the insect.

As constituted in the Genera insectorum (Bickhardt, 1916) the Abraeinae are a heterogeneous assemblage. A study of genital structure correlated with external characters indicates that of the genera previously placed in the group only the following may be retained: *Abraeus*, *Acritus*, *Halacritus*, *Aeletes*, *Spelaeacritus*, *Plegaderus*, *Eubrachium*, and *Phloeolister*; *Acritomorphus* gen. nov. and the genera which have comprised the subfamily Teretriinae may be added, and the Abraeinae may then be characterized as follows:

Antennae inserted "on the front" medial to the eyes, the antennal fossae cutting into the margin of the front; composed of eight segments in addition to the club, the latter variable and consisting of from one to three segments. Labrum with setigerous punctures. Dorsal elytral striae not developed, though vague oblique basal impressions may be present. Antennal cavities open, consisting of fossae which are situated either laterally and immediately in front of the procoxae, or in the anterior angles of the prothorax; in the latter case they may extend posteriorly to the procoxae. Prosternum without a lobe; prosternal alae longitudinally incised for the reception of the antennal funicle in repose. Anterior margin of mesosternum generally produced at middle though the production is usually covered by the basal flange of the prosternal keel so that the mesosternum appears truncate or obtuse anteriorly. Tibial adornment highly variable, usually finely multispinulose or setose, sometimes with only a few spinules. Aedeagus without an articulating ring-shaped or tubular basal piece, though the ventral posterior edge of the tegmen is sometimes produced as an apodeme<sup>1</sup> of varying length which may be strongly deflexed.

Of the genera to be removed from the Abraeinae, *Bacanius*, *Anapleus*, and *Abraeomorphus* may be placed in the Dendrophilinae. Why they were not thus assigned before is difficult to explain, since there is not a single character which would justify their being placed elsewhere. Presumably they were adjudged to be related to *Acritus* and *Abraeus* because of their minute size. *Onthophilus*, *Epiechinus*,<sup>2</sup> *Glymma*, and *Peploglyptus* cannot be satisfactorily placed until revisional studies of the Histeromorphae have been made. All of these have a well-developed prosternal lobe, and the aedeagus in *Onthophilus* and *Epiechinus* possesses a tubular or ring-shaped articulating basal piece, respectively. The genitalia of

<sup>1</sup> The basal piece may actually be fused to the rest of the tegmen and the "apodeme," when present, is probably a part of the fused basal piece.

<sup>2</sup> There is reason to suspect that these genera may belong in the Tribalinae.

*Glymma* and *Peploglyptus* have not been examined, since both of these are monotypic genera represented by unique types.

In order to indicate the relationships of the genera of the Abraeinae, it is convenient to divide the subfamily into tribes. Since this has not previously been done, the following may be regarded as new, though naturally they have no nomenclatorial status.

#### KEY TO THE TRIBES OF ABRAEINAE

1. Hind tarsi with four segments . . . . . 4. *Acritini*  
Hind tarsi with five segments . . . . . 2
2. Antennal cavities as in *Acritus*, large, situated in the anterior angles of the prothorax and extending posteriorly to the procoxae. . 3. *Acritomorphini*  
Antennal cavities situated in front of the procoxae, well separated from the anterior prothoracic angles. . . . . 3
3. Pronotum with a longitudinal groove on each side, these often connected by a transverse, median or submedian groove . . . . . 2. *Plegaderini*  
Pronotum without such grooves. . . . . 4
4. Form oval or round, usually rather strongly convex; basal margin of prosternal keel not incised to receive an angulate convex mesosternal projection.  
1. *Abraeini*  
Form cylindrical; basal margin of prosternal keel angulately incised to accommodate the mesosternal projection. . . . . 5. *Teretriini*

#### Tribe 1. Abraeini

This tribe contains but one genus, *Abraeus*, and is sufficiently characterized in the key to obviate further definition.

#### Tribe 2. Plegaderini

##### KEY TO THE GENERA

1. Prosternum divided into four lobes, the anterior and posterior lobes separated by two transverse, lancet-shaped lobes. . . . . *Phloeolister* Bickhardt  
Prosternum simple or with a deep, median, saddle-shaped excavation . . . . . 2
2. Prosternum simple . . . . . *Eubrachium* Wollaston  
Prosternum with deep lateral sulci and a large, very deep, transverse, saddle-shaped excavation, the margins of which are internally fringed with dense pubescence. . . . . *Plegaderus* Erichson

#### Tribe 3. Acritomorphini

This tribe contains the single isolated genus described below.

***Acritomorphus* gen. nov.**

Genotype *Acritomorphus praecursor* sp. nov.

*Diagnosis.*—Size small. Form elongate-oblong. Antennae inserted on the front; club with two pubescent annuli, one at apical third, the other approximate to the apical margin. Labrum with setigerous punctures. Marginal pronotal stria present, lateral striae absent. Scutellum visible, rather large, equilateral. Elytra with only a marginal epipleural stria. Prosternum truncate behind, long, with a rather narrow keel which is set off by striae, and a broad non-striate anterior region which is produced and somewhat resembles a prosternal lobe. Antennal cavities large, situated in the anterior prothoracic angles and extending posteriorly to the procoxae. Anterior margin of mesosternum not produced, feebly emarginate. Protibiae expanded apically, slender basally, oligodenticulate. Meso- and metatibiae with a few marginal spinules in a single row. Tarsal segments 5-5-5; tarsomeres 1-4 of the protarsi each with a normal ventral seta and one which is flattened, expanded, and transparent. Aedeagus without a ring-shaped articulating basal piece; the tegmen with a deflexed, ventral, basal projection which is apparently an apodeme for muscle insertions.

*Remarks.*—This genus possesses characters which seem to indicate a position between the Teretriini and less specialized members of the Abraeinae, though it could hardly be regarded as being a type directly ancestral to either. The antennal cavities resemble those of *Acritus* and allied genera, while the prosternum is similar to that of *Teretrius* but much longer.

***Acritomorphus praecursor* sp. nov.**

*Type* from Binaluan, northern Palawan Island, Philippine Islands. A male in the collection of Field Museum of Natural History.

*Description.*—Form elongate-oblong, subparallel, rather feebly convex. Color black, shining. Head finely, sparsely punctate. Pronotum strongly, moderately punctate, the punctures mostly somewhat elongate and usually separated by their diameters or a little more, a little finer along the sides and anterior margin; a few very fine punctures on the middle of the disk. Marginal pronotal stria complete, well impressed.

Elytral discal punctures similar to the larger pronotal punctures, a few of them finer along the suture; flanks more finely and a little

more closely punctate. Propygidial and pygidial punctures round and deep, a little larger than the pronotal punctures and mostly separated by less than their diameters. Marginal epipleural stria complete, very close to the margin. Epipleural fossette not distinct, alutaceous.

Prosternum rather long, very finely, sparsely punctate; that portion of the keel enclosed by striae is rather narrow, extending about three-fourths the prosternal length; carinal striae fine, subcariniform, feebly divergent apically, not united apically or basally; prosternum finely, strongly and more closely punctate anteriorly than on the enclosed keel; apical margin with a stria (very close to the edge) which does not quite reach the lateral stria on each side. Anterior mesosternal margin feebly, broadly emarginate; marginal mesosternal stria entire, well impressed and continuous on each side with the lateral metasternal stria, which is straight, oblique, and extends nearly to the hind coxa. Meso- and metasternal disks finely, sparsely punctate, the punctures becoming moderately coarse in the region of the metacoxae.

Protibiae slender basally, abruptly expanded on a little more than apical half, the external margin of the expanded portion bearing four or five minute denticles. Mesotibiae with about four slender spinules on outer edge, the most anterior of which is located at basal two-fifths. Metatibiae with two apical spinules on outer edge.

Length 1.73; width 1.07 mm.

*Remarks.*—The modified setae of the protarsi may be a male secondary sexual character.

#### Tribe 4. Acritini

##### KEY TO THE GENERA

1. Eyes absent; sides of head with a forwardly projecting lobe where the eyes are ordinarily present; scutellum not visible. . . . . *Spelaeacritus* Jeannel  
Eyes present; sides of head normal. . . . . 2
2. Scutellum not visible; epistoma with a marginal stria along each side and often along anterior margin (pl. 1, fig. 4); pygidium usually with a continuous stria along lateral and apical margins; mesosternal disk usually with a row of parallel, longitudinal, sulciform punctures or sulci which extend anteriorly from the meso-metasternal suture (pl. 1, figs. 2, 3) . . . . . *Aeletes* Horn  
Scutellum visible, though sometimes minute; epistoma and pygidium not margined; mesosternum without sulciform, parallel, longitudinal punctures, though in *Acritus* the meso-metasternal stria rarely may be very strongly and crenately punctate and superficially resemble the sculpture found in *Aeletes* . . . . . 3



3. Prosternal striae parallel at base, rather strongly divergent anteriorly; protibiae distinctly expanded apically, their outer margins adorned with spinules; mesosternum projecting forward, its marginal stria strongly angulate (pl. 1, fig. 5) *Halacritus* Schmidt

Prosternal striae (a) parallel, or (b) divergent posteriorly, or (c) divergent anteriorly and posteriorly, or (d) feebly divergent anteriorly; protibiae slender and finely multisetose (rarely expanded and bearing spinules, but the prosternal striae are not divergent anteriorly in these species); anterior mesosternal margin not strongly projecting as in *Halacritus*, the marginal stria at most rather feebly angulate *Acritus* Le Conte

### Genus *Acritus* Le Conte

#### *Acritus tuberculatus* Wenzel and Dybas

*Acritus tuberculatus* Wenzel and Dybas, Field Mus. Nat. Hist., Zool. Ser., 22, p. 439, 1941—Colombia (Villavicencio).

Brazil: Nova Teutonia, Santa Catherina, forty specimens, October, 1941 (collected by Fritz Plaumann).

Dutch Guiana: Paramaribo, two specimens, June 4, 1927 (Cornell University Collection).

British Guiana: Tumatumari, one specimen, July 2, 1911 (A.M.N.H.).

#### *Acritus atomus* Le Conte

*Acritus atomus* Le Conte, Proc. Acad. Nat. Sci. Phila., 6, p. 291, 1853—Cuba.

*Acritus atomulus* Marseul (in error), Ann. Soc. Ent. Fr., (4), 2, p. 694, pl. 8, fig. 3, 1862—Louisiana (New Orleans).

Cuba: Havana, eight specimens, January and December, 1929; Marianao, one specimen, July 16, 1929; Caisuita, two specimens (all collected by Alexander Bierig).

The name *atomulus* Marseul, placed as a synonym of *atomus*, must be considered as applying to a distinct North American species, possibly one known to American workers under some other name. Marseul's figure shows an antescutellar pronotal stria, a character not found in the Cuban *atomus*, a species allied to *exiguus* Erichson and *tuberculatus*.

#### *Acritus ignobilis* Lewis

*Acritus ignobilis* Lewis, Biol. Centr.-Amer., Coleop., 2, pt. 1, p. 238, pl. 7, fig. 2, 1888—Panama (Volcan de Chiriqui).

Puerto Rico: Boqueron, one specimen, from cow dung, November 18, 1936 (U.S.N.M.); Mayaguez, one specimen, from cow dung, April, 1936 (U.S.N.M.).

Cuba: Havana, one specimen, June 9, 1929; Marianao, one specimen, May 19, 1929 (collected by Alexander Bierig).

This species has been recorded from Puerto Berrio and Puerto Salgar, Colombia, by Wenzel and Dybas (l.c.).

***Acritus exiguus* Erichson (= *Bacanius subdepressus* Blatchley)**

*Acritus exiguus* Erichson, Jahrb. Ins., 1, p. 208, 1884.

*Bacanius subdepressus* Blatchley, Can. Ent., 54, p. 13, 1922.

The writer has examined the type and several paratypes of Blatchley's *subdepressus* and found it to be identical with *A. exiguus*.

**Genus *Halacritus* Schmidt**

The species of the genus *Halacritus* are maritime and without a known exception are found in and under decaying seaweed. Specific information regarding their food habits is lacking, but it is possible that they might be scavengers rather than predators. The group has previously been regarded as constituting a subgenus of *Acritus*, but it is a well-defined assemblage, morphologically<sup>1</sup> and ecologically.

To date only four species of *Halacritus* have been recognized; in the following section six species are added (four of them new), a generic name is placed in synonymy, and a provisional key to the known species of the world is outlined.

***Halacritus* Schmidt (= *Paracritus* Brethes)**

*Halacritus* Schmidt, Bull. Soc. Ent. Fr., 1893, p. ciii, 1893.

*Paracritus* Brethes, Rev. Chil. Hist. Nat., 27, p. 40, 1923.

Brethes' species *australis*, the type of *Paracritus*, is probably a synonym of *riparius* Bickhardt. The type of *australis* is from the state of Santiago; *riparius* is known from Concepcion, Valparaiso, Guayacan, and Iquique.

***Halacritus parallelus* Casey<sup>2</sup>**

*Acritus* (*Halacritus*) *parallelus* Casey, Mem. Coleop., 16, p. 251, 1916—West Virginia (Fort Monroe).

<sup>1</sup> It might be well to note that the aedeagus in *Halacritus* does not closely resemble that found in any of the species of *Acritus* examined by the writer.

<sup>2</sup> At the time this paper was written, the author had not yet seen Casey's types of *parallelus* or the additional specimens recorded above. Since then the writer has been able to study the types, but no examples of *maritimus*, a closely related species, were available for comparison, consequently no attempt has been made to separate them in the key, though the two are distinct. The inner wings of *parallelus* can be seen through the elytra and seem to be well developed.

Maryland: Piney Point, two specimens (U.S.N.M.; collected by Hubbard and Schwarz).

### **Halacritus salinus** Le Conte

*Acritus salinus* Le Conte, Proc. Amer. Phil. Soc., 13, p. 402, 1878—Florida (Cedar Keys).

Florida: Dunedin, two specimens (collected by W. S. Blatchley).

### **Halacritus lividus** Lea

*Acritus lividus* Lea, Trans. Ent. Soc. Lond., 1924, p. 258, 1925—Lord Howe Island.

Though there are no examples of this species at hand, it is obvious from Lea's description that *lividus* belongs in *Halacritus*.

### **Halacritus glabrus** sp. nov.

*Type* from Albany, West Australia. A specimen of undetermined sex in the collection of Rupert L. Wenzel.

*Paratypes*.—Five specimens, same data as the type; three in the collection of Field Museum, two in the collection of Rupert L. Wenzel.

*Description*.—Form oblong-oval. Color dark reddish-brown, strongly shining. Surface glabrous throughout, with the exception of the feebly alutaceous mesepimera. Head very finely, strongly, somewhat sparsely punctate.

Pronotal punctures fine, strong and rather sparse, noticeably sparser at sides and anterior angles. Elytral punctures sparse, as large medially as the coarsest pronotal punctures but shallower and becoming sparser and finer laterally, the flanks being virtually impunctate. Disk with an oblique impression basally near the sides. Marginal elytral stria alone present, complete, well impressed, its outer edge finely cariniform.

Prosternum nearly smooth, with a very few fine punctures and with an extremely feeble indication of alutaceous ground sculpture. Meso- and metasternum finely, sparsely punctate; meso-metasternal stria strongly rounded at median angulation (not acute or subacute), outer edge subcariniform, continuous on each side with the lateral metasternal stria, which is very short, nearly absent. Meso-metasternal suture marked by a row of rather widely separated, coarse punctures.

Pygidia finely, very sparsely punctate; apical margin of pygidium somewhat elevated.

Protibiae eight- to ten-spinulose, spinules stoutest and longest apically. Mesotibiae six- to seven-spinulose, the spinules becoming rather long and slender apically. Metatibiae four- to five-spinulose, spinules not as strong as those of the mesotibiae.

Length 0.97–1.16; width 0.71–0.86 mm.

*Remarks.*—This is apparently the only known species which has completely non-alutaceous pygidia and an obsolete lateral metasternal stria.

***Halacritus lewisi* sp. nov.**

*Type* from Colombo, Ceylon. A specimen of undetermined sex in the collection of Field Museum of Natural History. Collected by George Lewis.

*Paratypes.*—Three specimens, same data as the type, in the collection of Field Museum.

*Description.*—Color yellowish-brown, strongly shining. Form oblong-oval. Surface not alutaceous with the exception of the pygidia, the metasternum immediately lateral and posterior to the middle coxae, the mesepimeron, the sides of the abdominal sterna, and the prosternum, which is feebly alutaceous apically and strongly so on the sides. Head strongly, sparsely punctulate, the punctures stronger on vertex. Pronotum very finely, strongly, sparsely punctate.

Elytral punctures much coarser than those of the pronotum and for the most part aciculate or subaciculate, the aciculations not anastomosed; flanks impunctate or nearly so. Inner wings reduced to small pads which are about one-third the length of the elytra. Marginal stria as in *glabrus*. Propygidium and pygidium not evidently punctate; apical margin of pygidium feebly reflexed.

Mesosternum with a few rather fine punctures; marginal stria complete, its median angulation obtuse and arcuate, continuous on each side with the oblique lateral metasternal stria which extends posteriorly about one-half the length of the metasternum. Metasternal disk finely punctate on about anterior half, the punctures on posterior half moderately coarse, all the punctures a little denser along the median line; elevated metasternal sides moderately coarsely or coarsely, sparsely punctate.

Protibiae seven- to eight-spinulose. Mesotibiae four- to five-spinulose. Metatibiae apparently two- to three-spinulose.

Length 0.90–1.01; width 0.60–0.72 mm.

*Remarks.*—The types of this species are from a series collected by Lewis, representatives of which were sent to Schmidt by Lewis under the name *Acritus algarum* sp. nov. In describing *algarum*, Schmidt retained Lewis's name but designated his own specimens from the Seychelles as the types; his description obviously does not apply to the Ceylon examples, though he did mention the specimens as supplementary to the type series.

***Halacritus alutiger* sp. nov.**

*Type* from Bentotta, Ceylon. A specimen of undetermined sex in the collection of Field Museum of Natural History. Collected in 1899 by Walther Horn.

*Paratypes.*—One specimen, same data as the type, and three specimens from Puttalam, Ceylon, in the collection of Field Museum. Collected in 1899 by Walther Horn.

*Description.*—Form oval. Color light yellowish-brown, sometimes clouded with darker brown, rather feebly shining. Surface distinctly alutaceous throughout, with the exception of the elytral scutellar region and the feebly alutaceous or smooth median area of the metasternum. Head deeply, rather sparsely punctulate. Pronotum finely, strongly, rather evenly and sparsely punctate, a few punctures somewhat larger basally.

Elytral punctures for the most part the same size and density as the pronotal punctures, but more elongate (subaciculate) and a trifle finer apically; scutellar region punctulate; epipleura impunctate. Marginal elytral stria very coarse, its outer margin finely cariniform. Pygidia with a few very feebly impressed, fine punctures; apical margin of pygidium a little reflexed.

Prosternal striae nearly parallel on basal two-thirds, thence arcuately diverging apically. Punctures very feeble if at all discernible. Mesosternum impunctate; marginal stria complete, its outer edge subcariniform and its median angle rather obtusely rounded, continuous on each side with the lateral metasternal stria; the latter oblique (at about an 80-degree angle to the transverse axis of the beetle), extending a little more than a third the length of the metasternum.

Protibiae ten- to eleven-spinulose. Mesotibiae six-spinulose. Metatibiae four- or five-spinulose.

Length 1.2-1.4; width 0.90-1.05 mm.

*Remarks.*—Colombo, the type locality of *lewisi*, is situated between Puttalam and Bentotta on the west coast of Ceylon. Thus

*lewisi* and *alutiger* have the same range at least in part. The types of *alutiger* had been identified by Lewis as *algarum*, though the two species are very different. Inasmuch as both Schmidt and Lewis obviously confused several species of *Halacritus*, it is probably best to regard with suspicion any distribution records, with the exception of the Seychelles, which have been published for *algarum*.

***Halacritus blackwelderi* sp. nov.**

*Type* from High Point on Parham Sound, five miles northeast of St. Johns, Antigua, British West Indies. A specimen of undetermined sex in the collection of the United States National Museum. Collected under seaweed, August 15, 1936, by R. E. Blackwelder.

*Paratypes*.—Five specimens, sex undetermined, same data as the type; three in the collection of the United States National Museum, one each in the collections of Field Museum and R. L. Wenzel.

*Description*.—Form oblong-oval, rather feebly convex. Color yellowish-brown, shining. Pygidium feebly alutaceous; prosternal keel, mesepimeron, elevated sides of metasternum, and sides of first abdominal sternum strongly alutaceous. Head deeply, rather sparsely punctulate.

Pronotum strongly, finely, sparsely punctate. Elytral punctures along the suture distinctly coarser than the pronotal punctures, but finer laterally; flanks punctulate. Pygidium sparsely punctulate.

Carinal striae of prosternum strongly divergent anteriorly. Meso- and metasternal disks sparsely punctulate (density variable in the series, one specimen being rather densely punctulate); anterior half of elevated metasternal sides with moderately coarse punctures.

Length 1.02–1.05; width 0.74–0.76 mm.

*Remarks*.—This species is related to *salinus* Le Conte. A specimen collected by Dr. Blackwelder at St. Kitts, British West Indies, October 9, 1936, may be *blackwelderi*, but it differs in several respects from the types and thus is not included in the series.

PROVISIONAL KEY TO THE SPECIES OF *HALACRITUS*<sup>1</sup> OF THE WORLD

1. Elytra strongly, strigosely punctate on apical half; metasternum coarsely punctate. . . . . *riparius* Bickhardt (1914, p. 310)
- Elytral punctures simple, or if at all strigose the metasternum is punctulate or moderately punctate, not coarsely so. . . . . 2

<sup>1</sup> Although the genotype, *algarum* Schmidt (1893, p. 103), is distinct from the other described species, it is not included in the key because the original description does not mention some of the characters used by the writer as alternatives in separating the species.

2. Entire surface alutaceous, though the disks of the elytra may be rather feebly so . . . . . 3  
 Elytra never alutaceous; pronotum alutaceous at sides and along anterior margin, if at all; under surface completely alutaceous in one species (see couplet 7) . . . . . 4
3. Under surface black; elytra with a smooth sutural space . . . . . *lividus* Lea  
 Under surface pale yellowish-brown, with a few dark areas; elytra equally as punctate along the suture as on disks . . . . . *alutiger* sp. nov.
4. Lateral metasternal stria extending obliquely posteriorly for about half the length of the metasternum, thence strongly recurved and extending anteriorly to the metasternal-mesepimeral suture (pl. 1, fig. 5).  
*maritimus* Le Conte  
*parallelus* Casey  
 Lateral metasternal stria obsolete or extending obliquely posteriorly for about half the length of the metasternum (pl. 1, fig. 5) and then terminating without recurving anteriorly, or broadly interrupted apically so that an oblique isolated portion may be present near the metasternal-mesepimeral suture . . 5
5. Lateral metasternal stria obsolete, scarcely entering upon the metasternal disk, if at all distinguishable (pl. 1, fig. 5) . . . . . *glabrus* sp. nov.  
 Lateral metasternal stria extending obliquely posteriorly for about half the metasternal length . . . . . 6
6. Metasternum punctulate, sometimes nearly smooth . . . . . 7  
 Metasternum moderately, strongly punctate throughout or posteriorly at least . . . . . 8
7. Lateral and anterior margins of pronotum, pygidia, and entire under surface alutaceous, though disks of meso- and metasternum may be feebly so.  
*salinus* Le Conte  
 Pygidia, prosternal keel, elevated metasternal sides, and sides of first abdominal segment alutaceous . . . . . *blackwelderi* sp. nov.
8. Metasternal punctures even from base to apex, very fine in a median longitudinal area, of moderate size on each side . . . *punctum* Aubé (1842, p. 232)  
 Metasternal punctures minute anteriorly, becoming moderate and strong posteriorly . . . . . *lewisi* sp. nov.

Species	Wing condition	Known distribution
<i>algarum</i> Schmidt	Subapterous	Seychelles
<i>alutiger</i> sp. nov.	Fully developed	Ceylon: Bentotta; Puttalam
<i>blackwelderi</i> sp. nov.	Fully developed	British West Indies: Antigua
<i>glabrus</i> sp. nov.	Fully developed	West Australia: Albany
<i>lewisi</i> sp. nov.	Subapterous	Ceylon: Colombo
<i>lividus</i> Lea	Not examined	Lord Howe Island. New South Wales: Sydney; Wallongong. S. Australia: Adelaide Dist.
<i>maritimus</i> Le Conte	Partially reduced, about as long as the elytra; sometimes complete?	California: Santa Barbara to San Diego
<i>parallelus</i> Casey	Not examined	Virginia: Fort Monroe
<i>punctum</i> Aubé	Fully developed	Maryland: Piney Point
<i>riparius</i> Bickhardt	Not examined	Mediterranean region
(?) <i>australis</i> Brethes		Chile
<i>salinus</i> Le Conte	Partially reduced, about as long as the elytra	Florida: Cedar Keys; Dunedin

The reduction of the inner wings in species of this genus is interesting; the distribution of each species and the condition of the wings, as far as they are known, are noted in the table on page 64.

Darlington (1936) has shown that ground beetles living along stream and river banks or their flood plains are characteristically fully winged, while in those species which live in woodlands and fields (excepting those living on plants) the wings may undergo various stages of reduction and atrophy. The reason advanced by Darlington for this difference is that wings have a high survival value in species which live in such an insecure habitat as the frequently flooded banks or near vicinity of streams and rivers, and that selection pressure consequently operates against mutations for wing atrophy that may appear. On the other hand, in a habitat where wings have no especial value, reduction and atrophy may take place in the absence of such selection pressure.

Interestingly enough, Darlington notes further that coast-dwelling beetles frequently have reduced wings, and he states that they probably have less need for flying wings than their inland relatives. Though this may be true in part, it hardly seems explanation enough, for, while it must be granted that the two habitats (seashore and river bank) each have unique characteristics, yet one finds in both the same general sort of highly variable physical factors which presumably make for the retention of wings in the riparian species. Perhaps the distinction lies in this: although ability to fly might be expected to have survival value in such a niche, nevertheless, because of strong coastal winds which would carry many flying individuals away from the narrow zone to which they are adapted (either to sea or inland), the reduction of wings and consequent loss of flight would have greater survival value than the alternative, and mutations for this character would be selected for. For example, specimens of *H. maritimus* from Redondo, California, which have been examined by the writer, have inner wings which are so much reduced that it is difficult to see how they could be capable of even very inefficient flight. However, Fall (1901) has recorded inland specimens from Pasadena and Pomona as "flying in the early evening." It would seem reasonable to assume, therefore, that within the population of *maritimus*, specimens with fully or nearly fully developed wings do occur. Since our knowledge of the biology of this species indicates that it is maritime, one might infer that such records as Fall's represent individuals which have been carried away from, or have flown away from (or both), the narrow breeding and feeding zone to which



they are adapted. Further, since such errant-winged individuals would not further perpetuate the species, or possibly to a limited extent only, mutations for reduction of the inner wings might be expected to be selected for within the population, other factors being equal. Although not all the species of *Halacritus* have reduced flying wings, the percentage which do is significant.

### Genus *Aeletes* Horn

In 1941 Wenzel and Dybas placed *Acritus simpliculus* Marseul and *A. rugulosus* Marseul in *Aeletes*; until that time only one other neotropical histerid (*ctenomyphilus* Bickhardt) was thus assigned. In the following section the writer adds to the genus seventeen neotropical species—fourteen of them new—places one name in synonymy, and gives a key to the known neotropical species.

#### *Aeletes simpliculus* Marseul (= *A. rugulosus* Marseul)

*Acritus simpliculus* Marseul, Ann. Soc. Ent. Fr., (3), 4, p. 616, pl. 14, fig. 15, 1856—Venezuela (Caracas).

*Aeletes simpliculus* Wenzel and Dybas, Field Mus. Nat. Hist., Zool. Ser., 22, p. 442, 1941.

*Acritus simpliciculus* Gemminger and Harold, Cat. Coleop., 3, p. 798, 1868.

*Acritus rugulosus* Marseul, l.c., p. 617, pl. 14, fig. 16, 1856—Venezuela (Caracas).

*Aeletes rugulosus* Wenzel and Dybas, l.c.

After examining a large series of specimens from Mexico and additional examples previously reported upon from Colombia, the writer is convinced that *rugulosus* is the female of *simpliculus*. Without exception, all the specimens studied bear this out. Similar sexual dimorphism, in which the elytral punctures of the male are simple and those of the female are strongly aciculate, is known for the European *Acritus nigricornis* Hoffmann, the female of which was described under the name *seminulum* by Küster.

#### *Aeletes termitophilus* sp. nov.

*Type* from Hamburg Farm, Reventazon, upper Limon, Costa Rica. A specimen of undetermined sex in the collection of the United States National Museum. Collected in a colony of *Coptotermes niger* Snyder, February 10, 1938, by Ferdinand Nevermann.

*Description*.—Form oval, rather strongly convex. Color deep reddish-brown, strongly shining. Marginal epistomal stria complete; epistoma feebly, sparsely punctulate. Entire surface otherwise

impunctate. Pronotum with an arcuate, strongly crenate antescutellar stria; antescutellar interval glabrous, without punctures or plicae.

Prosternal keel broader than it is long along the median line; striae distinctly arcuate; basal margin broadly, angulately emarginate for the reception of the projecting mesosternum. Anterior margin of mesosternum obtusely produced at middle. The usual meso-metasternal row of plicae replaced by a very strongly arcuate and strongly crenato-punctate stria whose middle portion arches a little more than halfway up the mesosternal disk. Lateral metasternal stria extending obliquely posteriorly and terminating without recurving anteriorly. Middle femora, when extended posteriorly, reaching more than half the distance from the meso-metasternal suture to the hind coxae.

Length 0.85; width 0.57 mm.

*Remarks.*—The emarginate basal margin of the prosternal keel, the projecting anterior mesosternal margin, and the character of the mesosternal stria separate *termitophilus* from all other described neotropical species of *Aeletes*.

***Aeletes schwarzi* sp. nov.**

*Type* from Cayamas, Cuba. A specimen of undetermined sex in the collection of the United States National Museum. Collected February 25 by E. A. Schwarz.

*Paratype.*—One specimen from the same locality as the type, in the collection of Field Museum of Natural History. Collected March 6 by E. A. Schwarz.

*Description.*—Form oblong-oval. Color stramineous. Head glabrous, sparsely punctulate; marginal epistomal stria present along the sides only. Pronotum without an antescutellar stria; surface aciculate punctate, the punctures strong and sparse, being moderately coarse and densest in front of the scutellum, becoming minute along the anterior and lateral margins. Elytral punctures aciculate, being strong and moderate along the suture (a trifle coarser basally) and becoming a little finer laterally, disappearing on the flanks; aciculations outwardly oblique. Pygidium strongly, finely, sparsely punctate; marginal stria fine, complete.

Prosternal keel finely, strongly, sparsely punctate, at least one-half longer than broad, the striae feebly arcuate, basal width about equal to the apical. Mesosternum coarsely, closely punctate, the punctures somewhat elongate, sometimes subconfluent; transverse row of elongate sulciform punctures or sulci absent. Metaster-

num similarly punctate anteriorly, the punctures apparently<sup>1</sup> becoming moderate and sparse posteriorly, at least on the elevated metasternal sides.

Middle femora, when extended posteriorly, reaching about half the distance from the meso-metasternal suture to the first abdominal sternum.

Length 0.80–0.86; width 0.60–0.62 mm.

*Remarks.*—This is the only neotropical species of *Aeletes* known to the writer which has aciculate pronotal punctures.

***Aeletes rugiceps* sp. nov.**

*Type* from Cayamas, Cuba. A specimen of undetermined sex in the collection of the United States National Museum. Collected March 6 by E. A. Schwarz.

*Description.*—Form elongate-oval, rather strongly convex. Color deep yellowish-brown, shining. Epistoma finely, transversely rugulose, and finely, very sparsely punctate; marginal epistomal stria present on the sides only; vertex feebly rugulose and punctulate. Pronotum minutely, sparsely punctulate; disk at middle with feeble, longitudinal rugulae, these becoming even less evident laterally. Antescutellar pronotal stria absent. Elytra with long, parallel, very feeble aciculations along the suture, these visible only in certain lights; disks microscopically punctulate. Pygidium obtusely pointed and a little produced at apex; surface glabrous, very sparsely, minutely punctate; marginal stria fine, complete, punctate.

Prosternal keel sparsely punctulate, about as long as wide at apex; carinal striae subparallel on basal half, arcuate and divergent apically (not strongly so). Meso-metasternal disk minutely, rather feebly, sparsely punctulate; mesosternal disk without a row of sulciform punctures or sulci.

Middle femora, when extended posteriorly, reaching slightly more than half the distance from the meso-metasternal suture to the first abdominal sternum.

Length 0.75; width 0.53 mm.

*Remarks.*—This species may be separated from its allies by the characters given in the key.

<sup>1</sup> Both the type and paratype are mounted in such a way that it is impossible to see the median and posterior areas of the metasternal disk.

***Aeletes troglodytes* sp. nov. (pl. 1, fig. 2)**

*Type* from Aripo Valley, Trinidad, British West Indies. A specimen of undetermined sex in the collection of the Museum of Comparative Zoology. Collected deep in a cave at 2,600 feet elevation, April 19, 1935, by Neal A. Weber.

*Description*.—Form oval, moderately convex. Color reddish-brown, shining. Epistoma with a few fine punctures; marginal stria present on each side but not along anterior edge. Marginal pronotal stria complete. Antescutellar stria absent. Basal margin crenated by a few fine punctures. Elytra impunctate; marginal elytral stria complete. Propygidium smooth. Pygidium finely, transversely rugose, the rugae long.

Prosternum between a third and a fourth longer than greatest width, basal width about equal to the apical; carinal striae distinctly, but not strongly, inwardly, arcuate. Marginal mesosternal stria absent behind the prosternum, continuous on each side with the lateral metasternal stria which recurves anteriorly and extends to the metasternal-mesepimeral suture. Meso-metasternal suture marked by a row of deep punctures, of which the median ones are elongate and longitudinal, the lateral ones round; two discal, widely separated mesosternal punctures behind the anterior margin.

Protibiae with dense short setae on about apical half of outer margin. Mesotibiae with sparse, very fine, short setae and an apical spinule on outer edge. Metatibiae apparently without adornment on outer margin.

Length 0.90; width 0.66 mm.

*Remarks*.—*A. troglodytes* is related to the North American *politus* Le Conte and differs from it chiefly in the characters of the pygidium and of the pro- and metasternum (figured for both species on pl. 1, figs. 2 and 3).

***Aeletes lissosternus* sp. nov.**

*Type* from Montserrat, British West Indies. A specimen of undetermined sex in the collection of the United States National Museum. Collected March 22, by H. G. Hubbard.

*Description*.—Form oblong-oval, moderately convex. Color stramineous, shining. Epistoma with a few very fine punctures, marginal stria present laterally only. Pronotal sides strongly arcuate and convergent. Pronotum and elytra apparently impunctate. Antescutellar pronotal stria absent. Pygidium impunctate, basal

margin strongly arcuate at middle, disk strongly convex near apex, marginal stria not evident.

Prosternal keel elongate, about twice as long as median width, the striae subparallel on basal half, divergent apically, but not strongly so. Mesosternum impunctate, without a transverse row of sulci. Metasternum impunctate. Region of meso-metasternal suture transversely impressed. Posterior margin of first abdominal sternum deeply emarginate at middle for the reception of the following segments when retracted.

Legs slender, middle and hind tarsi filiform. Middle femora, when extended posteriorly, reaching the hind coxae and almost reaching the first abdominal sternum (medial to the hind coxae).

Length 0.80; width 0.62 mm.

*Remarks.*—This species belongs to the group containing *aciculatus* sp. nov. and *floridae* Marseul by virtue of its long legs and filiform tarsi as well as the deeply emarginate first abdominal sternum; the latter is probably a secondary male character, as in *floridae*.

#### *Aeletes laevis* sp. nov.

*Type* from Santarem, Brazil. A specimen of undetermined sex in the collection of Carnegie Museum. Collected in April.

*Description.*—Form oval, moderately convex, color reddish-brown, shining. Marginal epistomal stria present along sides and anterior margin; epistomal punctures sparse. Pronotum, elytra, and under side impunctate. Pygidium finely, transversely rugulose; marginal stria well impressed. Prosternal keel slightly broader than long, carinal striae distinctly, inwardly arcuate, but not strongly so. Mesosternal disk rather broadly impressed at middle; sulciform punctures somewhat as in *troglydites*, though more numerous and not as long at middle. Marginal mesosternal stria continuous posteriorly on each side with the lateral metasternal stria, which extends obliquely posteriorly for about a third the length of the metasternum and then recurves anteriorly to the metasternal-mesepimeral suture. Posterior margin of metasternum (between the hind coxae) broadly, feebly, outwardly arcuate. Middle femora, when extended posteriorly, almost reaching the posterior coxae.

Length 0.77; width 0.63 mm.

*Remarks.*—This species is closely related to *troglydites* and may be separated from it by the characters given in the key.

***Aeletes dybasi* sp. nov. (pl. 1, fig. 1)**

*Type* from Cordoba, Vera Cruz, Mexico. A male in the collection of Field Museum. Collected July 11, 1941, by Henry S. Dybas.

*Paratypes*.—Twelve specimens, same data as the type; one specimen from Penuela, Vera Cruz, July 17, 1941; one specimen from El Fortin, Vera Cruz, July 12, 1941; in the collection of Field Museum of Natural History. Collected by Henry S. Dybas.

*Description*.—Form oval, strongly convex. Color reddish-brown, strongly shining. Upper surface very sparsely, remotely punctulate, excepting the pygidia, which are strongly punctulate. Marginal epistomal stria present along sides only.

Pronotum with an evenly (not strongly) arcuate and strongly crenate antescutellar stria, which is a little wider than a third of the basal pronotal width; antescutellar interval smooth. Marginal stria complete. Elytra with two or three poorly defined longitudinal impressions laterally and basally. Marginal elytral stria complete, well impressed.

Prosternal keel strongly, sparsely punctulate, a little longer than greatest width; carinal striae strongly arcuate, divergent anteriorly and posteriorly; basal width a little less than the anterior. Marginal mesosternal stria subcariniform, absent behind the prosternum, continuous on each side with the lateral metasternal stria which extends obliquely posteriorly for about two-thirds the metasternal length and terminates near the metasternal-metepisternal suture. Disk with two oblique crenate striae as illustrated. Meso-metasternal suture represented by a dark line. Pygidium without marginal stria.

Protibiae with fine, short, dense setae along outer margin on a little more than apical half. Mesotibiae with a row of seven or eight fine short setae on outer margin. Metatibiae with four or five inconspicuous setae on outer edge.

Length 0.71–0.82; width 0.56–0.67 mm.

*Remarks*.—This is one of the described New World species of *Aeletes* which lacks both a marginal pygidial stria and a row of longitudinal plicae or elongate punctures on the mesosternal disk. The oblique mesosternal striae are distinctive.

***Aeletes rectistrius* sp. nov.**

*Type* from Ortoire River, five miles southeast of Rio Claro, Trinidad, British West Indies. A specimen of undetermined sex

in the collection of the Museum of Comparative Zoology. Collected January 3, 1935, by Neal A. Weber.

*Paratypes*.—Four specimens, same data as the type; two in the collection of the Museum of Comparative Zoology, two in the collection of Field Museum.

*Description*.—Form oval, moderately convex. Color reddish-brown, shining. Epistoma very finely, sparsely punctate; marginal stria present along sides only. Marginal pronotal stria complete. Pronotal disk impunctate. Antescutellar stria straight, very finely and closely crenate, present on about middle third of basal pronotal width and abruptly terminating on each side without running parallel to basal margin, the latter crenated by a row of distant fine punctures; antescutellar interval not plicate. Elytra impunctate; marginal elytral stria fine, complete. Pygidia impunctate; pygidium with a fine, well-impressed marginal stria along apical and lateral margins.

Prosternum rectangular, about a fourth longer than greatest width, striae feebly arcuate, basal width equal to the apical. Marginal mesosternal stria absent behind the prosternum, continuous on each side with the lateral metasternal stria which recurves anteriorly and reaches the metasternal-mesepimeral suture. Meso-metasternal suture marked by a row of longitudinal punctures which are shortest laterally.

Outer margins of protibiae fringed with dense, short setae on a little more than apical half. Mesotibiae with two or three fine spinules on outer edge near apex. Metatibiae without spinules or setae on outer margins.

Length 0.73–0.77; width 0.48–0.52 mm.

*Remarks*.—This species is allied to *laeviusculus* Marseul and may be separated from it by the characters given in the key.

***Aeletes subniger* sp. nov.**

*Type* from Villavicencio, Meta Intendencia, Colombia. A male in the collection of Rupert L. Wenzel. Collected from under bark, July 25, 1938, by Henry S. Dybas.

*Paratypes*.—Two examples, same data as the type; one in the collection of Field Museum, the other in the collection of Edward S. Ross.

*Description*.—Form oval, rather strongly convex. Color brownish-black, shining. Head strongly, sparsely, very finely punctate.

Lateral and anterior margins of epistoma with a continuous marginal stria.

Pronotum sparsely, deeply, moderately punctate, the punctures finer along the sides. Antescutellar stria arcuate, strongly crenate, present on about middle half of basal pronotal width; antescutellar interval plicate, the median plicae neither well impressed nor reaching posteriorly to the basal margin. Marginal pronotal stria complete.

Elytra sparsely punctulate on outer half and apically on inner half, the punctures a little stronger basally on inner half; a few apical punctures along suture may be finely aciculate; surface glabrous in the scutellar region, elsewhere somewhat dulled by an extremely fine and feeble alutaceous sculpture which is detectable only under high magnification (about  $\times 144$ ). Marginal elytral stria fine and complete, finely and crenately punctate on apical half.

Pygidia sparsely, strongly, rather finely punctate, pygidium with a well-impressed stria along apical and lateral margins.

Prosternal keel about a fourth longer than broad, striae feebly arcuate, subparallel, basal and apical widths equal, surface sparsely, deeply, rather finely punctate. Marginal mesosternal stria absent behind the prosternum (though represented there in one specimen by a row of disconnected punctures), continuous on each side with the lateral metasternal stria, which recurves anteriorly and reaches the metasternal-mesepimeral suture; mesosternal disk with a few punctures, tumid in a narrow area behind the prosternum; meso-metasternal suture marked on middle three-fourths by a row of longitudinal plicae which extend a little more than halfway up the mesosternal disk. Metasternal disk for the most part sparsely punctulate, the punctures larger anteriorly; elevated sides with sparse, strong, moderate punctures.

Length 1.05–1.16; width 0.75–0.79 mm.

*Remarks.*—At hand are two specimens from Caracas, Venezuela, which have the elytral punctures aciculate on inner half from about basal fifth nearly to apex. These may be females of *subniger*.

***Aeletes rugipygus* sp. nov.**

*Type* from Tilaran, Guanacaste, Costa Rica. A specimen of undetermined sex in the collection of the United States National Museum. Collected March 3, 1934, by Ferdinand Nevermann.



*Description.*—Form rather elongate-oval, moderately convex. Color deep brownish-black. Head very sparsely punctulate. Marginal epistomal stria present along the sides only.

Pronotum very finely, sparsely punctate, the punctures a little stronger medially. Antescutellar stria strongly crenate, feebly arcuate and feebly re-entrant at middle, well separated from the basal pronotal margin for about the middle third of its width, very close to the basal margin laterally. Antescutellar interval plicate, the plicae indistinct at middle. Surface apparently very feebly alutaceous, this sculpture discernible only under favorable lighting.

Elytra sparsely punctulate, the punctures coarser (though still fine) along the suture on about basal two-thirds, those near the middle very feebly aciculate. Pygidium transversely rugulose. Marginal stria fine, complete.

Prosternal keel about a third longer than broad, the striae parallel basally, very feebly divergent apically; keel sparsely punctulate, distinctly convex anteriorly. Mesosternum with a row of sulciform punctures of rather even size which extend anteriorly from the meso-metasternal suture about one-third (or a trifle more) the length of the mesosternal disk. Metasternum very sparsely, minutely punctate.

Middle femora, when extended posteriorly, reaching a little more than one-half the distance from the meso-metasternal suture to the first abdominal sternum.

Length 0.90; width 0.63 mm.

*Remarks.*—This species is rather close to *subniger*, but the latter differs in the following respects: (1) pygidium glabrous and strongly, finely punctate; (2) marginal epistomal stria complete; (3) elevated metasternal sides strongly, sparsely, rather finely punctate; (4) mesosternal sulci less even, some reaching to middle of mesosternal disk or a little beyond.

### *Aeletes assimilis* sp. nov.

*Type* from Cayamas, Cuba. A specimen of undetermined sex in the collection of the United States National Museum. Collected January 15 by E. A. Schwarz.

*Description.*—Form rather elongate-oval, moderately convex. Color yellowish-brown, shining. Head sparsely punctulate, glabrous; marginal epistomal stria present along the sides only.

Pronotum strongly, moderately, sparsely punctate at middle, the punctures becoming finer laterally; surface alutaceous at middle,

the sculpture becoming feeble laterally. Antescutellar stria strongly crenate, present on about middle third of basal width; antescutellar interval plicate, except at middle.

Elytra microscopically, sparsely punctulate. Pygidium very finely, sparsely punctulate, its surface feebly, transversely rugulose, the rugulae short.

Prosternal keel sparsely punctulate, a little longer than wide at apex; carinal striae rather feebly arcuate and subparallel basally, a little more strongly divergent apically. Mesosternum with a row of about twelve closely placed, parallel, sulciform punctures which are longest at middle and extend anteriorly from the meso-metasternal suture more than halfway up the mesosternal disk. Metasternal disk very feebly alutaceous; punctures very fine and sparse, not becoming coarser on the elevated sides.

Middle femora, when extended posteriorly, reaching about one-half the distance from the meso-metasternal suture to the anterior margin of the first abdominal sternum (medial to the hind coxae).

Length 0.76; width 0.55 mm.

*Remarks.*—The type does not appear to have a marginal pygidial stria, but owing to the manner in which it is mounted, it is impossible to check upon this character with certainty. *Assimilis* is related to *nevermanni* and *simpliculus*, but may be separated from them by the characters given in the key.

***Aeletes nevermanni* sp. nov.**

*Type* from Hamburg Farm, Reventazon, upper Limon, Costa Rica. A specimen of undetermined sex in the collection of Field Museum of Natural History. Collected January 4, 1932, on freshly cut sections of trees, by Ferdinand Nevermann.

*Paratypes.* Seven specimens, same data as the type; one each in the collections of the United States National Museum, the Museum of Comparative Zoology, and Edward S. Ross.

*Description.*—Form oblong-oval, rather feebly convex. Color reddish-brown, shining. Head minutely, sparsely punctate, epistomal punctures setigerous; marginal stria of epistoma complete. Pronotum strongly, sparsely punctate medially, the punctures becoming extremely fine and almost indistinguishable laterally. Antescutellar stria arcuate or feebly angulate at middle, strongly crenate, present on about middle third of width of basal margin; antescutellar interval not distinctly plicate, though it has a few

vague, punctiform impressions. Basal pronotal margin strongly crenated by punctures. Marginal pronotal stria complete.

Elytra microscopically, sparsely punctulate on lateral halves (flanks smooth); along the suture, from basal third to apex, the punctures are stronger and near the middle may be feebly aciculate. Pygidia glabrous, very finely, sparsely punctate.

Prosternal keel about one-half longer than apical width; carinal striae very feebly divergent basally, a little more distinctly so apically. Mesosternum with parallel, longitudinal sulci which are absent on each lateral fourth and which traverse the length of the disk. Marginal stria continuous with the lateral metasternal stria, which recurves anteriorly and reaches the mesepimeral-metasternal suture. Metasternal disk very sparsely punctulate, the elevated sides with a few moderate punctures.

Length 0.68–0.73; width 0.53–0.57 mm.

*Remarks.*—This species is allied to *subniger* and *simpliculus*, and may be separated from them by the characters given in the key.

#### ***Aeletes sulcipennis* sp. nov.**

*Type* from Hamburg Farm, Reventazon, Limon, Costa Rica. A specimen of undetermined sex in the collection of Field Museum of Natural History. Collected on freshly cut sections of trees, January 4, 1932, by Ferdinand Nevermann.

*Paratypes.*—Four specimens, same data as the type; three in the collection of Field Museum, one in that of the Museum of Comparative Zoology. Two specimens, same locality as the type, in the collection of the United States National Museum; collected on fallen *Virola warburgii*, February 23, 1934, by Ferdinand Nevermann.

*Description.*—Form oblong-oval, rather feebly convex. Color deep reddish-brown, shining. Head finely, very sparsely punctate. Marginal epistomal stria complete.

Pronotum strongly, moderately, sparsely punctate at middle, the punctures sparser and much finer laterally. Antescutellar stria strongly crenate, rather feebly arcuate, present on about middle third of basal width; antescutellar interval feebly and incompletely plicate.

Elytra sparsely, moderately punctate basally and moderately coarsely punctate apically; flanks and scutellar region smooth or nearly so; apices of elytra (apical fourth or a little more) with deep,

longitudinal, parallel, closely placed, punctate sulci. Marginal elytral stria strong, complete.

Propygidium finely punctate basally, moderately coarsely, deeply, rather closely punctate apically. Pygidium coarsely, rather closely punctate, the punctures sparser and finer apically. Marginal stria well impressed.

Prosternal keel with a few fine punctures, nearly twice as long as median width, the striae rather feebly arcuate and subparallel basally, noticeably more divergent apically. Mesosternal disk strongly plicate, the plicae long and reaching to the anterior margin. Marginal stria absent behind the prosternum, continuous on each side with the lateral metasternal stria, which is coarsely punctate and recurves anteriorly to the metasternal-mesepimeral suture. Metasternal disk microscopically, sparsely punctate or smooth at middle, the punctures moderate in front of the hind coxae; punctures coarse and sparse on the elevated metasternal sides.

Length 0.83-0.89; width 0.60-0.67 mm.

*Remarks.*—All the type specimens of *sulcipennis* were originally mounted on cards with a rather thick adhesive and in addition were very dirty and difficult to clean; consequently, certain details could not be observed easily, and the tibiae could not be studied at all. The elytral sulci are unique among the described species of *Aeletes*. At hand is a specimen which is very similar to the types but which lacks the elytral sulci and which has finer pronotal punctures, sparsely punctate pygidia and only a very few punctures on the elevated metasternal sides. There is a rather remote possibility that this could be the male of *sulcipennis*, but this cannot be confirmed from the material before me.

#### *Aeletes aciculatus* sp. nov.

*Type* from Hamburg Farm, Reventazon, Limon, Costa Rica. A male in the collection of Field Museum of Natural History. Collected on a freshly cut tree section, January 4, 1932, by Ferdinand Nevermann.

*Paratypes.*—Two specimens, same locality as the type, in the collection of the United States National Museum. Collected on fallen *Virola warburgii*, February 23, 1934, by Ferdinand Nevermann.

*Description.*—Form broadly oval, rather feebly convex. Color deep reddish-brown. Eyes with distinct setae. Epistoma with

moderate, deep, setigerous punctures, the setae rather long; marginal epistomal stria complete; vertex with finer setigerous punctures, the setae shorter and finer than those of the epistoma.

Pronotum with moderate, deep punctures in a rather broad median area, the punctures separated by one to one and one-half times their diameters and becoming sparser and very fine laterally. Antescutellar stria strongly crenate, rather feebly arcuate, occupying a little more than middle third of width of basal margin; antescutellar interval not plicate. Basal margin strongly crenated by punctures.

Elytra deeply, moderately punctate, excepting elytral flanks above and a narrow area along the suture near the scutellum, these areas being sparsely punctulate; on basal half of elytra the punctures mostly separated by one and one-half to two times their diameters, but on apical half a trifle closer with their intervals finely aciculate.

Pygidium glabrous; surface deeply, rather densely, moderately coarsely punctate on a little less than basal half; apically the punctures become a little finer and along the middle become sparser as well. Marginal stria strong, complete.

Prosternal keel very sparsely, minutely punctate, about one and one-half times longer than greatest width; base a little wider than apex; carinal striae feebly arcuate, divergent basally and apically. Mesosternum with two oblique striae as in *dybasi* (but not crenate), the interval between them with longitudinal, parallel sulci which traverse the length of the disk and become shallower posteriorly. Region of meso-metasternal suture broadly, shallowly, transversely impressed. Marginal mesosternal stria continuous on each side with the lateral metasternal stria, which is coarsely impressed and extends obliquely posteriorly more than one-half the length of the metasternum and terminates abruptly without recurving anteriorly; an oblique stria, which apparently represents the portion of the lateral metasternal that ordinarily extends anteriorly, extends posteriorly from the mesepimeral-metasternal suture but is rather widely separated posteriorly from the lateral metasternal stria. Metasternal disk sparsely punctulate at middle, the punctures becoming coarser laterally, particularly in front of the hind coxae where they merge with the coarse punctures of the elevated sides. Apical margin of first abdominal sternum deeply, rather broadly, arcuately emarginate; disk with a longitudinal stria on each side medial to the coxae; this stria extends posteriorly to the hind margin without curving outwardly and anteriorly.

Hind tarsi slender, as long as the tibiae, the ventral surface of the first tarsomere with short, dense, stiff hairs.

Length 0.92; width 0.72 mm.

*Remarks.*—The apical emargination of the first abdominal sternum is probably a secondary male character as it is in *floridae* Marseul, a closely allied species from North America, which may be separated from *aciculatus* as follows:

1. Lateral metasternal stria extending obliquely posteriorly and terminating without recurving anteriorly; apical elytral punctures seldom connected with each other by the aciculations which are sometimes entirely independent of the punctures. . . . . *aciculatus* sp. nov.
- Lateral metasternal stria recurving anteriorly and extending to the meso-pimeral-metasternal suture; apical elytral punctures, when aciculate, connected by the aciculations. . . . . *floridae* Marseul

#### KEY TO THE NEOTROPICAL SPECIES OF AELETES<sup>1</sup>

1. Basal margin of prosternal keel broadly, angulately emarginate for the reception of the obtusely produced anterior mesosternal margin; mesosternal disk with a strongly arcuate and strongly crenato-punctate line whose median portion approaches the anterior mesosternal margin. . . . . *termitophilus* sp. nov.  
Basal margin of prosternal keel truncate (pl. 1, figs. 1-3); anterior margin of mesosternum truncate at middle. . . . . 2
2. Pronotum with an antescutellar stria. . . . . 9  
Pronotum without an antescutellar stria. . . . . 3
3. Mesosternum with a transverse row of parallel, closely placed sulci or sulciform punctures which extend anteriorly from the meso-metasternal suture (pl. 1, figs. 2, 3). . . . . 6  
Mesosternum without a transverse row of parallel sulci or sulciform punctures. . . . . 4
4. Pronotum and elytra aciculate punctate; mesosternum coarsely, closely punctate. . . . . *schwarzi* sp. nov.  
Pronotum and elytra impunctate or simply punctate; if punctate, feeble rugulae or aciculations which are independent of the punctures may be present; mesosternum minutely punctate or smooth. . . . . 5
5. Surface impunctate; epistoma not rugulose; prosternal keel elongate, about twice as long as wide at middle; middle femora long, reaching the hind coxae when extended posteriorly. . . . . *lissosternus* sp. nov.  
Upper and under surfaces minutely, sparsely punctulate; epistoma finely, transversely rugulose, vertex feebly so; prosternal keel about as long as wide at apex; middle femora, when extended posteriorly, reaching only slightly more than one-half the distance from the meso-metasternal suture to the first abdominal sternum (medial to the hind coxae). . . . . *rugiceps* sp. nov.
6. Elytra apically with an obliquely strigose microsculpture. . . . . *ctenomyphilus* Bickhardt (1920, p. 236)  
Elytra without such microsculpture. . . . . 7

<sup>1</sup> The characters of *ctenomyphilus*, *gulliver*, *laeviusculus*, and *poeyi* are taken from the original descriptions.

7. Mesosternum with a row of parallel, closely placed sulci or sulciform punctures (pl. 1, figs. 2, 3); pygidium with a marginal stria laterally and apically ..... 8  
 Mesosternum without a row of sulci or sulciform punctures, but with two fine, oblique, crenate striae (pl. 1, fig. 1); pygidium without a marginal stria ..... *dybasi* sp. nov.
8. Prosternal keel between one-third and one-fourth longer than wide at apex (pl. 1, fig. 2); marginal epistomal stria present along sides only. .... *trogodytes* sp. nov.  
 Prosternal keel hardly longer than broad; marginal epistomal stria present along lateral and anterior margins ..... *laevis* sp. nov.
9. Elytra impunctate ..... 10  
 Elytra punctate, sometimes very finely so ..... 12
10. Antescutellar interval (between basal margin and antescutellar pronotal stria) plicate; pronotum impunctate ..... *gulliver* Marseul (1856, p. 623)  
 Antescutellar interval not plicate ..... 11
11. Pronotum sparsely punctulate; antescutellar stria arcuate; elytra microreticulate apically ..... *laeviusculus* Marseul (1856, p. 622)  
 Pronotum impunctate; antescutellar stria straight; elytra not microreticulate apically ..... *rectistrius* sp. nov.
12. Elytra with a row of longitudinal, parallel, closely placed sulci across apices. .... *sulcipennis* sp. nov.  
 Elytra sometimes aciculate or strigosely punctate, but never with a transverse row of sulci ..... 13
13. Antescutellar stria parallel with the basal margin, the interval narrow. .... *poeys* Marseul (1862, p. 695)  
 Lateral portions of antescutellar stria sometimes parallel with the basal margin of the pronotum; medial portion of antescutellar stria straight or outwardly arcuate ..... 14
14. Elytra moderately or finely and deeply punctate at least in a broad sutural area ..... 15  
 Elytra punctulate, sometimes a little more coarsely and strongly punctate in a narrow sutural area, but never markedly so ..... 16
15. Strong punctures of elytra extending laterally to the flanks; lateral metasternal stria extending obliquely posteriorly and terminating without recurving anteriorly; middle femora, when extended posteriorly, nearly reaching the intercoxal disk of the first abdominal sternum ..... *aciculatus* sp. nov.  
 Strong punctures of elytra present in a broad sutural area, not extending laterally to the flanks; lateral metasternal stria extending posteriorly for a short distance and then recurving anteriorly to the metasternal-mesepimeral suture; middle femora extending a little more than half the distance from the meso-metasternal suture to the first abdominal sternum. .... *simpliculus* Marseul (1856, p. 616)
16. Marginal epistomal stria complete ..... 17  
 Marginal epistomal stria present along the sides only ..... 18
17. Elytra sparsely punctulate, the punctures coarser, though still fine, along the suture on about basal two-thirds; pygidium distinctly, transversely rugulose, without evident punctation; prosternal keel about one-third longer than broad; mesosternum with a row of rather uniform sulciform punctures

which extend anteriorly from the meso-metasternal suture for about one-third the length of the disk.....*rugipygus* sp. nov.

Elytra minutely, uniformly, sparsely punctulate; pygidium sparsely punctulate and feebly, transversely rugulose, the rugulae short; prosternal keel a little longer than it is wide at apex; mesosternal row of sulciform punctures longest at middle, extending anteriorly for more than half the length of the disk.....*assimilis* sp. nov.

18. Form oval, rather strongly convex; color deep brownish-black; elytra glabrous in the scutellar region, elsewhere dulled by an extremely fine, feeble, alutaceous ground sculpture, details of which can be detected only under high magnification (about  $\times 150$ ); pygidium strongly, rather finely, sparsely punctate; prosternal keel about one-fourth longer than broad.

*subniger* sp. nov.

Form broader, oblong-oval, rather feebly convex; color reddish-brown; elytra glabrous throughout; pygidium very finely, sparsely punctate; prosternal keel about one-half longer than broad....*nevermanni* sp. nov.

### Subfamily Trypanaeinae

#### *Trypanaeus fucatus* sp. nov. (fig. 10)

*Type* from Mount Duida, Venezuela. A male in the collection of the American Museum of Natural History. Collected November 4, 1928, by G. H. H. Tate.

*Allotype*.—Female, same data as the type, in the collection of the American Museum.

*Paratypes*, three males, same data as the type; one in the collection of the American Museum and two in the collection of Field Museum.

*Description*.—Ground color black, elytra pale yellow with the exception of apical third and a rather narrow lateral margin. Form narrowly cylindrical.

*Male*.—Front with a rather deep round impression whose lateral margins are distinct and which anteriorly is continuous with a shallowly impressed or flat rostral area. Vertex with a few moderate, sparse punctures. Rostral sides straight, not elevated, distinctly convergent anteriorly; anterior margin subtruncate, the tip with two very feeble elevations.

Pronotum coarsely, irregularly punctate; punctures noticeably finer and sparser on apical fifth, somewhat denser along the median line. Marginal stria absent behind the head, sometimes interrupted along the sides behind the lateral angulation.

Elytral punctures fine, densest along the suture, the apical margin, and the lateral margin (where they become elongate); elsewhere the punctures are very sparse, being nearly absent in the humeral region.



Pygidium rather short, conical, the sides somewhat compressed; apex pointed from above (not spiniform), rounded in lateral profile; punctures setigerous, moderately coarse, separated by their diameters, becoming finer apically.

Prosternal keel impunctate, similar to that of *transversalis* Bickhardt (1916, text fig. 18, p. 46); sides margined and distinctly elevated, converging anteriorly, the striae united in a rounded arch apically; basal margin angulately incised.

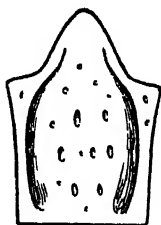


FIG. 10. *Trypanaeus fucatus* sp. nov.  
Male. Mesosternal disk.

Mesosternum without a median groove, similar to that of *T. breviculus* Marseul (Bickhardt, op. cit., text fig. 14, p. 45) but more elongate, marginal stria rather coarse, not abbreviated though somewhat feeble posteriorly in two examples; disk with a few elongate, fine punctures. Metasternum sparsely, irregularly punctate, the punctures about half the size of the pronotal punctures, densest along the middle. Protibiae five-dentate. Metatibiae feebly expanded apically.

Length 2.85–2.95; width 0.75–0.90 mm.

Length 2.85–2.95; width 0.75–0.90 mm.

*Female* a little more elongate than the male. Front and rostrum with two longitudinal sulci, these margined laterally by elevated ridges and separated by a strongly elevated median carina which anteriorly unites with the strongly converging lateral ridges to form an acute apex; apical half of rostrum bent upward at a right angle to the front; posterior end of the median carina (at the level of the anterior margin of the eyes) elevated as a large, acute tubercle on each side of which the sulci are divided by transverse ridges into anterior and posterior portions, the latter being large deep foveae; neither sulci nor carinae extend further posteriorly than a point even with the middle of the eyes. Preocular tubercles minute.

Pronotum without indications of median tubercles and not flattened or excavated anteriorly; surface more shallowly, somewhat more sparsely punctate than in the male. Mesosternal sides converging behind the lateral angle, marginal stria obsolescent posteriorly. Metasternum a trifle more finely punctate posteriorly than in the male.

Pygidium shaped as in *T. quadricollis* Mars., the punctures dense, moderately coarse and setigerous.

*Remarks.*—The male is apparently related to *transversalis* Bickhardt, the female of which is unknown, but that species has the head flat and has a very differently shaped mesosternum (Bickhardt, op. cit., text fig. 18, p. 46); *fucatus* runs to *pictus* in Bickhardt's key but that species is larger (5 mm.) and has the front only lightly impressed.

The female is related to *bimaculatus* Erichson and *cornifrons* Lewis. In the latter species the mesosternum is narrower, and its sides diverge posteriorly for the entire length, the striae deep and approximate; the sulci of the head are not divided into anterior and posterior portions, the rostral apex is longer (neither as abruptly nor as markedly bent upward), and the preocular tubercles are considerably larger. *T. bimaculatus* is larger (4.5–5 mm.), it has a longer, less narrowed and less markedly bent rostrum with blunt apex, large preocular tubercles, a less pronounced median carina, shallower sulci, and the median tubercle of the head is placed on a level with the posterior margin of the eyes; in addition, the anterior margin of the pronotum is somewhat excavated and has very shallow coarse punctures.

Lewis gives the length of *cornifrons* as 5.5 mm. At hand is a specimen which seems to be from the same lot as the type of that species; it answers well to the description but is hardly larger than *fucatus*. Unless the species varies remarkably more in size than is usual in this genus, it is either an unusually closely allied smaller species from the same locality, or Lewis's measurements are grossly inaccurate; in view of other such mistakes by that author the latter alternative is a distinct possibility.

### Subfamily Sapriniinae

#### Genus *Saprinus*

##### *Saprinus oblongus* sp. nov.

*Type* from Tancitaro, Michoacan, Mexico. A female in the collection of Field Museum of Natural History. Collected from under moss at 6,000 feet elevation, June 25, 1941, by Harry Hoogstraal.

*Description.*—Color black with a feeble aeneous luster. Form oblong-subparallel. Head with a short, oblique, obsolescent stria on each side in front of the eyes; surface finely, strongly, rather densely punctate.

Pronotum a little less than twice as broad as long (22:13), sides nearly straight and convergent from base to apical fourth, thence arcuate to apical angles. Basal margin broadly arcuate, with two rows of strong, moderate punctures. Disk smooth, sides strongly, densely, moderately punctate basally, the punctate area becoming broader and the punctures coarser in the region of the anterior angles. Marginal stria coarse, punctate, complete.

Elytra very sparsely, strongly punctulate, excepting apical fourth, which is moderately, sparsely punctate, and the region of the oblique humeral stria, which is finely, strongly punctate. Epipleura strongly, very sparsely punctulate, punctures becoming a little coarser at middle. Marginal epipleural stria fine, impunctate, complete. Marginal elytral stria strong, punctate, extending around apical angle and halfway across apical margin, thence obsolete. Sub-humeral striae absent. Oblique humeral strongly impressed, present on basal third. Dorsal striae one to four well impressed, punctate, the first and second subequal, extending a little beyond the middle; third dorsal longer, extending to near apical third; fourth dorsal not quite reaching the middle, arched toward the suture at base, the arch feebly impressed and consisting chiefly of punctures. Sutural stria very fine, abbreviated at basal third and a little before apex.

Pygidia feebly micro-alutaceous. Propygidium densely punctate, the punctures fine at base, becoming coarser apically. Pygidium moderately coarsely punctate, the punctures separated by their diameters or a little less, scarcely finer or sparser apically.

Prosternum apically distinctly deflexed and rather strongly convex, middle of apical margin with a stria; keel of moderate width, very finely, sparsely punctate and feebly convex; carinal striae punctate, their outer edges subcariniform, divergent basally, thence subparallel and becoming somewhat coarser anteriorly, abbreviated at apical fifth. Lateral striae very coarse, terminating anteriorly in deep foveae.

Marginal mesosternal stria complete, punctate, united on each side with the coarsely punctate lateral metasternal stria. Mesosternum very sparsely punctulate at middle, the punctures becoming moderately coarse laterally. Metasternum impunctate within the lateral stria, with the exception of an apical band of coarse punctures on each side near the hind coxa, the punctures becoming finer and sparser at middle; elevated metasternal sides very coarsely punctate.

Protibiae nine-denticulate, the teeth blunt and rather small. Mesotibiae with a row each of marginal setae and very blunt short spinules; a longitudinal row of short fine spinules also present along outer face near middle. Metatibiae similar to the preceding, but the spinules of the marginal row finer, becoming progressively longer apically.

Length 3.57; width 2.38 mm.

*Remarks.*—This species belongs to Horn's group IV, which includes *pectoralis*, *posthumus*, *paeminosus* and allies. It may be readily distinguished from related species by its distinctly oblong, sub-parallel form (as in *aequipunctatus* Horn). The females of certain southeastern United States species possess similar extremely variable pygidial excavations which are entirely lacking in the males; their identity cannot be determined definitely without a study of the Casey types.

At hand is a specimen which is tentatively associated with *oblongus*; it is a female from Orizaba, Vera Cruz, collected with ants from under a stone, July 9, 1941, by C. H. Seevers. This example differs from the type as follows:

Size a little smaller: length 3.2, width 2.14 mm. Dorsal striae a little longer; elytra moderately punctate on apical third. Pygidium not alutaceous, the punctures becoming noticeably finer and sparser apically; sulci narrower and confined to apical fourth. Prosternal striae a little shorter (abbreviated at apical fourth), not as coarse anteriorly. Apical band of punctures interrupted at middle of metasternum.

Inasmuch as the species of this group are among the most variable of the Saprinae, it is probable the Orizaba specimen and the type are conspecific.

### ***Saprinus carinipennis* sp. nov.**

*Type* from Chapada, Brazil. A male in the collection of Carnegie Museum. Collected in November.

*Description.*—Form oval, moderately convex. Color reddish-brown, shining. Vertex sharply, deeply punctulate; epistoma with punctures of similar size but with appearance imbricate. Supra-orbital stria fine, complete. Frontal stria feeble, carinate, apparently connected on each side with the supraorbital, complete, though very feeble anteriorly at middle of epistoma where it is strongly arcuate.

Pronotal sides rather feebly arcuate and not very strongly convergent on basal two-thirds, thence strongly arcuate and convergent to apices; apical angles not impressed, somewhat rounded. Marginal stria complete. Disk finely, sparsely punctate in a broad antescutellar area, the punctures becoming finer and sparser anteriorly, and becoming a little coarser and denser in a rather narrow longitudinal area along the sides, particularly subapically. Basal margin with two rows of fine strong punctures.

Elytra finely, evenly punctate medial to the second dorsal stria, the punctures separated by one to one and one-half times their diameters, slightly finer in the region of the scutellum, slightly larger apically; punctures not very deeply impressed but sharply defined, their bottoms flat; punctures of first interval finer; flanks strongly punctulate. Marginal epipleural stria complete, its outer edge finely, feebly subcariniform. Marginal elytral stria complete, strongly impressed, its outer edge rather strongly subcariniform, not continued across elytral apex. External subhumeral deeply impressed, distinct from, and parallel with, the marginal elytral, present on a little less than basal fourth. Internal subhumeral extending from near base to apical sixth, feeble basally and fine at apex, elsewhere strong and with a subcariniform, crenate, outer edge. Oblique humeral deeply impressed, close to, and parallel with, the first dorsal. First dorsal stria coarsely impressed, extending nearly to apical third, its outer edge strongly, obtusely, subcariniform; second, third, and fourth dorsals replaced by well-defined carinae, the second about as long as the first, the third and fourth respectively shorter, the fourth reaching a little beyond the middle; third with a finely crenulate, inwardly bent, basal hook. Sutural stria consisting of a finely crenulate line on about basal fifth, united with the fourth in an arch.

Pygidium moderately punctate basally, the punctures separated by slightly more than their diameters, becoming fine apically; extreme apex at right angles to the rest of the pygidium and more sparsely punctate, set off from it by two oblique, almost transverse, deep sulci which are narrowly separated at middle and extend laterally to the margin.

Prosternum sparsely punctulate, its structure basically as in *azureus* and allies but without apical foveae; keel flat and shallowly impressed on basal fourth, becoming progressively convex and then slightly compressed and obtusely carinate to within a short distance of apex; carinal striae subparallel on a little less than basal half,

thence feebly divergent and ascending to unite with the descending lateral striae a little beyond the middle, thence continuing to ascend to about one-fifth from apex, thence descending to unite with the apical marginal stria. Mesosternal disk sparsely, strongly, finely punctate; anterior mesosternal margin feebly, broadly, outwardly arcuate (not emarginate); marginal stria complete, its outer edge finely subcariniform along anterior margin, rather strongly cariniform laterally. Metasternal disk smooth with the exception of a transverse apical band of moderate, strong punctures, these finer at middle; elevated sides coarsely, closely punctate. First abdominal sternum with a single, fine subcariniform stria on each side medial to the hind coxae, the stria feebly oblique and extending from basal to apical margin; intercoxal disk moderately coarsely, sparsely punctate on basal half, sparsely punctulate on apical half.

Protibiae expanded, outer margin arcuate and bearing seven spinules of which the apical spinule and the two basal ones are fine, the rest strong; first five spinules occupying a little more than apical half. Outer margin of mesotibiae with a submarginal row of short, rather inconspicuous spinules and a marginal row of eight to nine which become longer apically and alternate with strong setae. Metatibiae with one or two short, setiform spinules on basal half, and five or six progressively larger ones on apical half.

Length 3.1; width 2.33 mm.

*Remarks.*—The members of the genus *Platysaprinus* have the first dorsal stria as in *carinipennis*, but the latter is the only saprinine species known to the writer which has dorsals two to four replaced by strong carinae.

### Genus *Geomysaprinus* Ross

The interesting association of beetles of the family Histeridae and other insects with burrowing mammals and reptiles has been pointed out by various authors. In 1940 Ross erected a new genus, *Geomysaprinus*, to receive two new saprinine species, *G. tibialis* and *G. goffi*; these were collected from burrows of the Florida pocket gopher, *Geomys f. floridanus* Audubon and Bachman, and seem to be allied to *Chelyoxenus xerobatis* Hubbard, a species which apparently is confined to the burrows of the gopher tortoise, *Gopherus polyphemus* Daudin. In the spring of 1940, Mr. J. L. Hill collected a single male of *Saprinus rugosifrons* Fall, which proved to be a third and remarkable species of *Geomysaprinus*; the specimen was taken

from human feces at Berwyn, Illinois (May 14), an area in which *Geomys* is not represented. Though it was collected "at large," its true ecological niche may well be that of a commensal predator in rodent burrows; the thirteen-lined ground squirrel, *Citellus t. tridecemlineatus* Mitchell, is abundant in the locality. The following redescription is based upon the male type in the Fall Collection at the Museum of Comparative Zoology, the Berwyn example in the collection of Field Museum, and a female from the type locality in the collection of the United States National Museum.

***Geomysaprinus rugosifrons* Fall (pl. 2, fig. 2, a, b)**

*Saprinus rugosifrons* Fall, Can. Ent., 51, p. 213, 1919—Canada (Awerne, Manitoba).

*Description: Male.*—Form oval. Color black, shining. Head finely rugulose, the rugulosity short, distinct, evenly distributed; supraorbital stria finely cariniform; frontal stria absent; a short longitudinal stria is imperfectly connected to the supraorbital and extends anteriorly to the level of the anterior margin of the eye on each side. Mandibles acutely margined.

Pronotum slightly less than twice as broad as long, sides feebly sinuate on basal three-fourths, strongly arcuate and convergent on apical fourth. Anterior angles obtusely rounded. Marginal stria complete, extending inward along the basal margin for a short distance on each side. Disk rather sparsely, finely, deeply punctate with punctulation intermingled, the punctures becoming longitudinally rugulose in a rather broad area on each side. Basal margin with two rows of moderate, deep, closely placed punctures, which become more numerous in front of the scutellum.

Elytra together distinctly broader than the pronotum (43:36) and a little broader than long. Sides not very strongly convergent, distinctly arcuate at base and near apex, nearly straight at middle. Marginal epipleural stria finely cariniform, impunctate, complete. Marginal elytral stria complete, extending from base to apex and thence around outer apical angle and along apical margin to suture; along the side of the elytron this stria is punctate and has a subcariniform outer edge, but across the apical margin it is impunctate and has a very finely cariniform outer edge. External subhumeral stria close to, but distinct from, the marginal elytral, impunctate, present within basal fourth, not reaching to base; internal subhumeral stria punctate, extending from apical fourth to a little beyond the middle, not united with the oblique humeral, which is

finely impressed and present on slightly more than basal third. Dorsal striae crenately punctate, the sutural more finely so than the others; first dorsal extending to apical third or fourth; second, third, and fourth dorsals progressively shorter, though the third may be longer than the first; fourth dorsal extending to the middle or a little beyond, arched at base and united with the sutural which extends nearly to apex; the basal ends of the second and third dorsals bent inwardly at right angles for a short distance. Surface finely, not densely punctate (the punctures separated by one to two times their diameters), in an area which extends laterally to the second dorsal stria and anteriorly to the middle between the third dorsal and sutural striae; between the second and third dorsals the punctures extend slightly beyond apical third; elsewhere the elytra are sparsely, distinctly punctulate, except that a rather narrow longitudinal area along the flanks is slightly more coarsely and densely punctate.

Propygidium and pygidium finely, rather closely punctate, the punctures transversely elongate, their posterior margins often evanescent so that an imbricate appearance is effected; pygidial punctures rugulose along the sides; pygidium margined laterally and apically, the marginal stria deeply impressed, its outer edge subcariniform.

Prosternum densely punctulate along apical margin, elsewhere sparsely punctulate. Carinal striae subparallel, sinuous, most widely separated at middle, abbreviated at basal sixth and apical fourth, not united at either end; lateral striae strongly impressed, terminating in round deep foveae which are not united across apex by a line, though a feeble indication of a line is present.

Mesosternum moderately coarsely, rather densely punctate; marginal mesosternal stria complete, well impressed, its outer edge subcariniform. Meso-metasternal stria rather strongly, crenately punctate. Marginal mesosternal stria continuous with the lateral metasternal which extends obliquely to near the hind coxa on each side. Metasternum broadly, roundly, distinctly impressed at middle, this area moderately coarsely, rather densely punctate, the punctures bearing short setae; disk sparsely, finely punctate within the lateral metasternal stria on each side; elevated sides of the metasternum, mesepimera, and metepisterna coarsely, rather densely punctate; metepimera with longitudinally strioliform punctures. Abdominal sterna alutaceous. First sternum moderately punctate within the coxae, the punctures separated by one to two times their diameters and becoming sparser and markedly finer at middle near apex where



a large tubercle is present; a longitudinal, cariniform stria present on each side medial to the hind coxa; elevated sides rather coarsely, somewhat densely punctate, the posterior margins of the punctures evanescent. Sterna two to five with punctures similar to those of the pygidium, though they are more elongate and more frequently confluent on sterna four and five; fifth sternum ventrally produced and bitumescent at middle (see pl. 2, fig. 2, *a*), the disk of the produced area impunctate.

Protibiae as shown in pl. 2, fig. 2, *b*; meso- and metatibiae triseriately spinulose, the spinules rather slender, those of the marginal row the longest. Tarsomeres one to four of prolegs each bear a strongly expanded and flattened ventral seta in addition to a short normal seta; tarsomeres one to four of middle and hind tarsi each bear a single dorsal seta and a pair of slender ventral setae, the inner of which is twice the length of the outer; claws long, slender, equal.

*Female*.—Rugulosity of front of head sometimes united. Punctuation of pronotal disk stronger. The coarser apical punctures of the elytra extend nearly to base between the fourth and sutural striae and remain rather strong basally in the other interstrial spaces. Metasternal disk only feebly impressed in a rather narrow apical area, the discal punctures finer and bearing inconspicuous setae which can be seen only under very high magnification. First abdominal sternum feebly impressed and without a median apical tubercle, the punctures nearly uniform throughout (a trifle finer at middle). Fifth sternum strongly convex but not bitumescent at middle, a small foveole present on each side of the middle near base. Tarsomeres one to four of prolegs with both ventral setae normal.

*Measurements*.—Length 3.7–3.8; width 2.6–2.8 mm.

*Remarks*.—The elytra of the type and the topotypic female are distinctly alutaceous apically, but in the Berwyn example they are only feebly so. The modified setae of tarsomeres one to four of the male prolegs are a remarkable secondary sexual character which exists in all the saprinines examined, though it has not heretofore been noted in the literature. In the figure of the under side of the male (pl. 2, fig. 2, *a*), the only punctures shown are those bearing setae.

*G. rugosifrons* may be separated from *tibialis* and *goffi* as follows:

1. Internal subhumeral stria short, present from apical fourth to a little beyond the middle; prosternal foveae not transversely united across apex by a line; basal margin of pronotum with two rows of moderately coarse punctures which become more numerous at middle. *Male*: metasternum with rather

dense setigerous punctures, the setae conspicuous; first abdominal sternum with a large tubercle near apex; fifth abdominal sternum ventrally produced and bitumescent at middle (pl. 2, fig. 2, a) . . . . . *rugosifrons* Fall

Internal subhumeral complete or nearly so; prosternal foveae united across apex by a line; basal margin of pronotum with fine punctures. *Male*: metasternum sparsely punctate; first and fifth abdominal sterna without tubercles or bitumescent production. . . . . 2

2. Sutural stria united with the fourth dorsal; marginal elytral stria terminating at apical angle. *Male*: anterior tibiae with rows of fine, crenulate striae on the inner face in place of tarsal groove; metasternum not depressed medially, finely, evenly punctate, alutaceous throughout . . . . . *tibialis* Ross

Sutural stria abbreviated at basal third; marginal elytral stria extending around apical angle to suture. *Male*: anterior tibiae with a distinct, shallow tarsal groove, metasternum depressed medially, with a few coarse, median setigerous punctures. . . . . *goffi* Ross

### **Hypocaccus iris** Fall (= *H. alutiger* Wenzel)

*Saprinus iris* Fall, Can. Ent., 51, p. 214, 1919—Canada (Aweme, Manitoba).

*Saprinus alutiger* Wenzel, Can. Ent., 68, p. 789, 1935—Wisconsin (Lake Ripley).

Comparison of the types of *iris* and *alutiger* shows that only one species is involved; consequently *alutiger* must be placed as a synonym of *iris*. In addition to locality records of this species already published, Pentwater, Michigan, may be noted.

### **Reichardtia** gen. nov.

Genotype *Pachylopus pedator* Sharp, 1876, p. 25 (pl. 2, fig. 1, a, b)

*Diagnosis*.—Epistoma large, nearly twice as broad as long, its posterior margin distinctly elevated above the rest of the head and separated from it by a coarse, deep, inwardly arcuate groove; anterior margin of epistoma broadly, shallowly emarginate. Supra-orbital stria present, frontal stria absent. Vertex without transverse impressions, erosions, or wrinkles. Labrum nearly as broad as the epistoma, its anterior margin distinctly emarginate and impressed at middle.

Pronotum without a lateral stria. Marginal stria complete and continued along entire basal margin. Surface without punctures. Elytra with four dorsal striae and a sutural in addition to the strong, oblique humeral and a complete marginal elytral stria; the latter traverses the elytral apex to unite with the sutural. Pygidium large, triangular.

Prosternal keel strongly cariniform, not differentiated anteriorly; carinal striae short, united in a sharp apex between the procoxae; anterior prosternal margin bisinuate, pointed at middle; prosternal alae notched for the reception of the antennal funicle in repose.

Antennal cavities poorly defined. Mesosternum narrow, longer than broad (more distinctly so than in *Pachylopus*), its anterior margin with an acute projection which fits into a notch of the prosternum, a flange of the prosternal base covering it from below.<sup>1</sup> Meso-metasternal suture well marked. Metasternum short, strongly transverse. Sides of meso- and metasterna, the meso- and metathoracic pleurites, the sides of the first abdominal sternum, and the posterior margins of the remaining abdominal sterna with setigerous punctures which bear moderately long, fine yellow hairs.

Anterior femora normal. Protibiae expanded apically, the outer margin arcuate and bearing from sixteen to nineteen movable, flattened, narrowly lancet-shaped spinules which articulate in open sockets on the outer face and can be deflected ventrally. Meso- and metafemora very stout and swollen, particularly the metafemora, which are nearly twice as broad and thick as the mesofemora. Meso- and metatibiae as in *Pachylopus*.

*Remarks.*—This genus is named in honor of Axel Reichardt whose studies on the Sapriniinae form one of the few notable contributions to histerid taxonomy. The genotype, *pedator* (from New Zealand), was unknown to Reichardt at the time of his brief revision (1926) of the genera allied to *Pachylopus*. It does not remotely resemble the members of *Pachylopus*, *Neopachylopus*, and *Baeckmanniolus* in the structure of the protibiae and of the head.

### Subfamily **Dendrophilinae**

In the course of an investigation of the soil fauna of Georgia peach orchards, two examples of an undescribed, blind, subapterous histerid beetle were collected by W. F. Turner. The specimens were sent to the United States National Museum where they were determined as belonging to a new genus by Mr. Herbert S. Barber, who subsequently suggested to the writer that he describe them.

### **Geocolus** gen. nov.

Genotype *Geocolus caecus* sp. nov.

*Diagnosis.*—Form elongate-oval, moderately convex. Epistoma large, nearly as long as broad; frontal stria not present. Labrum setose, as broad as anterior margin of epistoma. Antennae eleven-segmented, inserted under the margin of the front; scape enlarged

<sup>1</sup> In *Pachylopus* and *Neopachylopus* the notch of the prosternal base and the median mesosternal projection are visible from below.

apically; second segment stout, nearly twice as broad as the following segments; club apparently three-segmented, with scattered erect longer setae and recumbent shorter setae which form annulae. Submentum transversely concave.

Anterior margin of pronotum broadly emarginate for the reception of the head. Marginal pronotal stria present, lateral striae absent. Scutellum not visible from above. Elytra not connate, without discal striae. Propygidium short, strongly transverse; pygidium broader than long, nearly vertical.

Prosternal keel flat, of moderate width, striate; lateral and lateral marginal striae ascending and terminating in irregular, shallow foveae which are united; prosternal lobe well developed, not separated from the keel by a visible suture; prosternal alae deeply and narrowly emarginate on each side to accommodate the antennal funicle in repose. Antennal cavities well developed, entirely open beneath, situated in the anterior angles of the prothorax and extending posteriorly to the procoxae. Mesosternum emarginate anteriorly. Metasternum without a median suture; metepisterna concealed by the elytral epipleura.

Protibiae expanded, their outer margins oligodenticulate; tarsal grooves poorly defined, their inner edges margined. Outer margins of meso- and metatibiae with setae and spinules in a single row.

*Remarks.*—*Geocolus* is tentatively placed in the subfamily Dendrophilinae because of prosternal and protibial structure. It differs from all other members of this group in having the antennal cavities situated in the anterior prothoracic angles and extending posteriorly to the procoxae. Within the subfamily it would occupy a position somewhat analogous to that of *Acritus* and allied genera in the subfamily Abraeinae. In general appearance *G. caecus* resembles certain species of *Isolomalus* and *Pachylomalus*, but in these genera the epistomal region is very much reduced, the male genital structures are very different, and the antennal cavities are situated at the middle of the hypomera. The genus *Triballodes* Schmidt, erected for a single rare Grecian species, *acritoides* Reitter, is apparently closely related to *Geocolus*, but the two can be separated as follows:

1. Eyes normally developed; scutellum visible from above; prosternal keel rather broad *Triballodes* Schmidt  
Eyes absent; scutellum concealed; prosternal keel of moderate width. *Geocolus* gen. nov.

*Triballodes* was placed in the tribe *Tribalini* by Bickhardt, but the genus cannot even be keyed out to the subfamily (Histerinae)

using Bickhardt's key (1917), much less be regarded as an ally of the other genera within the tribe.

Perhaps the most satisfactory disposition of the two genera would be to regard them as constituting a tribe within the Dendrophilinae.

**Geocolus caecus** sp. nov. (pl. 3, figs. 1-6)

*Type* from Peach County, Georgia. A specimen of undetermined sex in the collection of the United States National Museum. Collected April 27, 1939.

*Paratype* from Thomaston, Upton County, Georgia. A male in the collection of Field Museum. Collected through a soil funnel, July, 1936.

*Description*.—Form narrowly elongate-oval. Color pale reddish-brown. Surface micro-alutaceous throughout, with the exception of the sternal disks which are indistinctly or obsoletely so. Surface distinctly, sparsely, very finely punctate throughout; the elytra less strongly and more sparsely punctate than the pronotum, the punctures very sparse at apex. Frontal suture visible as an oblique dark line on each side (indicated by dotted line in pl. 3, fig. 3). Supraorbital stria represented on each side by a short curved stria above the insertion of the antennal scape and continued along the posterior margin of the vertex by a complete, feeble carinule. Eyes absent.

Pronotal length to width 5.5:7.5; lateral margins rather strongly deflected in front, nearly straight on basal half, arcuate and more strongly convergent apically. Marginal stria complete. Anterior angles acute. Basal margin strongly, evenly arcuate with a small antescutellar impression.

Elytra together a little longer than broad (9:8.3). Marginal elytral stria fine, subcariniform, extending from base to apex; marginal epipleural stria absent; epipleural fossette not defined. Metathoracic wings reduced to small pads.

Pygidium two-fifths broader than long.

Prosternal lobe with an apical marginal stria which forks on each side as an inverted U-shaped stria. Prosternal keel of moderate width, carinal striae finely cariniform, subparallel, not united anteriorly though they may be rather feebly united along basal margin. Lateral and lateral marginal striae finely cariniform, ascending and terminating on each side in irregular, ill-defined

anastomosed foveae. Mesosternum rather narrow and short, its anterior margin narrowly, not deeply emarginate, oblique on each side of the emargination. Marginal stria indistinct or absent along the emargination; laterally it is subcariniform and continuous with the lateral metasternal stria which extends obliquely a little more than a third the length of the metasternum and then recurves anteriorly to the mesepimeral-metasternal suture. An arcuate stria margins the posterior edges of the mesocoxal cavities. Meso-metasternal stria absent, the suture indicated by a dark line. Intercostal disk of first abdominal sternum with a subcariniform, longitudinal stria on each side which extends posteriorly nearly to the apical margin, thence laterally to a point near the lateral margin, and thence anteriorly to the metepimeral-metasternal suture.

Tibiae as figured.

Length 1.54; width 0.87 mm.

*Remarks.*—*Geocolus caecus* is the second blind histerid species known;<sup>1</sup> the blind, subapterous condition appears to be correlated with an obligate, soil-dwelling existence and parallels the modifications found in many cavernicolous insects.

### Genus *Bacanius* Le Conte

As pointed out by Wenzel and Dybas in 1941, the terminology of the lateral elytral striae in the genus *Bacanius* has been confused by various authors in the past. In studying further a considerable number of species, the writer has come to the conclusion that the stria called the "first dorsal" in such species as *subcarinatus* and *punctiformis* is in reality a subhumeral, but that it is entirely absent in other species, so that the marginal elytral stria is often thus named. Since an attempt to apply the proper terms would only confuse the worker who has an inadequate representation of species, the writer has decided to apply the term "first dorsal" to the innermost stria of the flank in all species; this application is to be understood in the following descriptions and key.

### *Bacanius subcarinatus* Wenzel and Dybas

*Bacanius subcarinatus* Wenzel and Dybas, Field Mus. Nat. Hist., Zool Ser., 22, p. 436, 1941.

Costa Rica: La Palma, two specimens, collected under loose bark by F. Nevermann, January 18, 1929, at 1,400 meters (U.S.N.M.).

<sup>1</sup> *Spelaeacritus anophthalmus* Jeannel was described from Fersine Cave, Asia Minor. The condition of the inner wings was not noted.

In one of these specimens the first dorsal stria is abbreviated basally on one side. The pygidia are finely, sparsely punctate; the elytral disks are a little more distinctly punctate than in the types. Color dark reddish-brown.

### **Bacanius debilitans** Casey

*Bacanius debilitans* Casey, Ann. N. Y. Acad. Sci., 7, p. 560, 1893.

Cuba: Cayamas, three specimens, collected March 4, January 1, and June 6 by E. A. Schwarz (U.S.N.M.).

### **Bacanius sculptus** Lewis

*Bacanius sculptus* Lewis, Biol. Centr.-Amer., Coleop., 2, pt. 1, p. 237, pl. 7, fig. 10, 1888.

Argentina: El Quemado, Jujuy, four specimens, collected May 3, 1926, by G. L. Harrington (U.S.N.M.). This species is now known from the West Indies and from Mexico to Argentina.

### **Bacanius rugisternus** sp. nov.

*Type* from Colombia. A specimen of undetermined sex in the collection of Field Museum.

*Paratypes*.—Fifteen specimens from the west slope of Volcan Irazu, Costa Rica, at an altitude of 1,500–2,000 meters; collected from under loose bark March 22, 1928, by Ferdinand Nevermann. One specimen from Vara Blanca, Costa Rica, at an altitude of 1,700 meters; collected from under loose bark, July 7, 1928, by Ferdinand Nevermann. Paratypes are in the collections of the United States National Museum, Field Museum, and Rupert L. Wenzel.

*Description*.—Color reddish-brown, shining. Form oval, strongly convex. Head with a few very fine punctures. Pronotum strongly, very finely, sparsely punctate. Marginal stria complete, crenulate and rather close to the edge along the anterior margin.

Elytra sparsely punctulate, the punctures coarser along the suture, apparently less distinct apically. Marginal epipleural stria not distinct; marginal elytral stria finely cariniform, complete. First dorsal stria finely cariniform, abbreviated at basal third, continued around the apical angle to the suture. Pygidium finely, strongly, sparsely punctate.

Prosternum with a few very fine punctures; carinal striae usually convergent anteriorly, sometimes rather strongly so, nearly parallel in the type; prosternal lobe large, a little longer than the keel,

with longitudinal, deeply impressed rugae. Meso-metasternal disk deeply punctulate, elevated sides with sparse, moderate punctures.

Protibiae expanded, outer margin with a fine tooth about one-fourth from apex. Mesotibiae with a fine spinule about one-third from apex.

Length 1.22–1.33; width 0.92–0.95 mm.

*Remarks.*—This species is apparently related to *convergens* and may be separated from it by the characters given in the key.

***Bacanius striatinotum* sp. nov.**

*Type* from Cacao, Tres Aguas, Alta Vera Paz, Guatemala. A specimen of undetermined sex in the collection of the United States National Museum. Collected April 15 by H. S. Barber and E. A. Schwarz.

*Paratype.*—A specimen of undetermined sex, same locality and collectors as the type, in the collection of Field Museum; collected April 24.

*Description.*—Form roundly oval, rather strongly convex. Color dark reddish-brown, shining. Head strongly, rather closely punctate, the punctures moderately coarse.

Marginal pronotal stria well impressed, complete, closely crenulate along the anterior margin. Pronotum moderately, strongly, sparsely punctate (a trifle more finely so than the head), the punctures separated by about twice their diameters or a little more, becoming finer laterally. Antescutellar stria strongly, crenately punctate, feebly arcuate.

Elytra with a marginal epipleural stria which is broadly arcuate and present on apical two-thirds; marginal elytral stria broadly interrupted at middle, present on about basal third and on a little more than apical third, medial to the marginal epipleural stria; first dorsal stria complete, extending around apical angle, thence across apical margin to suture and recurving along suture to apical fifth or sixth. A very fine stria is present along suture from near base to basal third. Elytra finely, sparsely punctate in a common sutural area which is narrowest basally; baso-laterally the disks are coarsely, sparsely punctate, the area narrowing somewhat apically, the coarse punctures becoming a little finer apically. Pygidium sparsely, moderately coarsely punctate, the punctures becoming finer apically.

Prosternal keel short, about as long as broad, and moderately, deeply punctate; lobe coarsely, closely, rugosely punctate. Meso-



sternal disk short, with a double row of deep, elongate punctures (along the meso-metasternal suture) which together give the appearance of being a row of sulciform punctures such as are found in *Aeletes*. Metasternal disk with a few moderate punctures along anterior margin and with sparse, coarse punctures along the elevated sides, elsewhere microscopically, very sparsely punctulate.

Protibiae with a denticle near apex and a row of fine setae thence to base.

Length 0.92-0.95; width 0.72-0.73 mm.

*Remarks.*—This is the only neotropical species of *Bacanius* known to the writer which has an antescutellar pronotal stria.

***Bacanius pusillus* sp. nov.**

*Type* from Penuela, Vera Cruz, Mexico. An example of undetermined sex in the collection of Field Museum. Collected July 17, 1941, by Henry S. Dybas.

*Paratypes.*—Two, same data as the type; two from Tezonapa, Vera Cruz, August 8, 1941 (H. Dybas); one from Tierra Blanca, Vera Cruz, July 28, 1941 (H. Dybas); four from Tamazunchale, San Luis Potosi, June 22, 1941, in rotten log (H. Dybas and C. H. Seevers).

*Description.*—Color reddish-brown, shining. Form oval, rather strongly convex. Front and epistoma with very fine, rather strong, sparse punctures. Pronotal punctation similar to that of the head but a little sparser. Marginal stria fine, complete, close to the margin and not crenulate behind the head.

Elytra impunctate, covering the propygidium. Marginal epipleural stria absent. Marginal elytral stria finely cariniform, extending from base to apex. First dorsal stria finely cariniform, complete, extending around apical angle to suture. Epipleura with a few irregular coarse impressions in the fossette between the marginal elytral and first dorsal striae. At the middle of each elytron a finely cariniform, transverse, feebly arcuate stria extends outwardly from the suture for about a third of the elytral width. Pygidium not as strongly inflexed as in most species, the punctures similar to those of the pronotum.

Prosternal keel very short, nearly twice as broad as long, impunctate; carinal striae straight, parallel, very finely cariniform. Prosternal lobe not strongly deflexed, short, as long as the keel, with an apical marginal stria which is united on each side with the lateral

prosternal striae; apical half of lobe with a few fine, deep punctures, some of which are connected. Mesosternum margined along the oblique sides but not at middle; meso- and metasternal disks impunctate; elevated metasternal sides with a few shallow, moderate punctures.

Protibiae expanded, the outer edge bearing five or six extremely small setae, without teeth. Mesotibiae with a few fine setae along outer margin and a small spinule just beyond middle. Metatibiae with very fine marginal setae.

Length 0.67–0.70; width 0.52–0.54 mm.

*Remarks.* This is one of the smallest species of *Bacanius* and may be separated from its allies by the characters given in the key.

***Bacanius sulcisternus* sp. nov.**

*Type* from Hamburg Farm, Reventazon, Limon, Costa Rica. A specimen of undetermined sex in the collection of the United States National Museum. Collected on a sandbank, January 2, 1935, by Ferdinand Nevermann.

*Paratypes.* Two specimens, same data as the type; one each in the collections of the United States National Museum and Field Museum.

*Description.* Form oval, moderately convex. Color rather pale yellowish-brown, shining. Head very finely, very sparsely punctate. Pronotum sparsely, deeply, moderately punctate at middle, the punctures somewhat finer anteriorly and laterally. Marginal pronotal stria complete, very finely and closely crenulate along the anterior margin; basal margin with a row of fine, very closely placed punctures, which crenate the edge.

Elytra with a complete epipleural stria and a complete "first dorsal" stria, the latter continued around apex to suture. A well-impressed sutural stria present on basal third. Surface finely, very sparsely punctate, the punctures becoming minute or disappearing laterally. Pygidium very finely, sparsely punctate.

Prosternal keel about as broad as long, distinctly convex anteriorly, the carinal striae parallel; prosternal lobe with deep, longitudinal rugae. Mesosternum with a row of sulci which extend anteriorly from the transversely impressed meso-metasternal suture for about half the length of the disk, the latter otherwise very sparsely, finely punctate. Metasternum sparsely punctulate, the punctures a little larger on the elevated sides.

Length 0.65-0.70; width 0.50-0.52 mm.

*Remarks.*—This very small species may be distinguished from other neotropical allies by its mesosternal sulci, which resemble those found in the genus *Aeletes*.

***Bacanius crenulatus* sp. nov.**

*Type* from Hamburg Farm, Reventazon, Limon, Costa Rica. An example of undetermined sex in the collection of Field Museum of Natural History. Collected May 1, 1929, by Ferdinand Nevermann from a nest of *Gymnostinops montezuma* Lesson.

*Description.*—Color reddish-brown, strongly shining. Form oval, rather strongly convex. Head and elytra remotely punctulate. Pronotum very finely, sparsely, strongly punctate. Marginal stria complete; rather distant from the edge and strongly, closely crenulate along the anterior margin.

Marginal epipleural stria absent. Marginal elytral stria complete, finely cariniform. First dorsal stria finely cariniform, abbreviated at about basal third, extending around apical angle to suture. Pygidium with a few very fine punctures.

Prosternum with a few very fine punctures; keel about as long as broad, carinal striae straight and rather strongly convergent apically. Prosternal lobe large, a little longer than keel, at middle (on basal half) with about three deep longitudinal rugae which encroach a little on the keel; marginal stria strongly impressed, united on each side with the lateral prosternal striae. Mesosternum with a marginal stria along the oblique sides only. Meso- and metasternal disks impunctate; elevated sides of metasternum with a few moderate punctures.

Protibiae expanded; outer margin rounded on basal half, thence straight to tooth (about one-fourth from apex), thence oblique to apex. Mesotibiae with a single fine spinule a little beyond the middle.

Length 0.88; width 0.63 mm.

*Remarks.*—This species is allied to *rugisternus* but is a smaller species with more finely punctate elytra and impunctate meso- and metasternal disks.

Seventeen species of *Bacanius* are now known from the new world. Of these, two, *ferrugineus* and *convergens*, are unknown to the writer and the characters given for them in the following key are taken from the original descriptions.

In *debilitans*, the first dorsal stria (sublateral stria of Casey) is extremely fine basally and may be confused with punctures, thus appearing to be abbreviated as it was thought to be by Casey. In order to avoid confusion the species has been included under both alternatives of No. 8.

#### KEY TO THE NEW WORLD SPECIES OF *BACANIUS*

1. Pronotum with an antescutellar stria *striatinotum* sp. nov.  
Pronotum without an antescutellar stria 2
2. Elytral punctures coarse, connected by short, deep grooves; first dorsal elytral stria arching across base and recurving posteriorly a short distance from the suture 3  
Elytral punctures sometimes coarse but never connected by deep grooves;<sup>1</sup> first dorsal stria frequently abbreviated basally, never arching across the base 4
3. Pronotal punctures dense, connected by deep longitudinal grooves throughout *scalptus* Lewis (1888, p. 237)  
Pronotal punctures sparse, connected by fine longitudinal grooves in a narrow area along anterior margin, elsewhere isolated and distinct. *punctiformis* J. L. Le Conte (1853, p. 288)
4. Elytra with a transverse stria near middle, this stria extending outwardly from the suture 5  
Elytra without such a stria 6
5. Form broadly oval; upper surface moderately coarsely, sparsely punctate; transverse elytral stria a part of a hamiform stria whose longitudinal portion extends anteriorly along the suture *hamatus* Lewis (1888, p. 238)  
Form more narrowly oval; pronotum very finely punctate; elytra impunctate; transverse elytral stria simple, not part of a hamiform stria. *pusillus* sp. nov.
6. Elytra with a well-impressed sutural stria on basal third; mesosternum with a row of sulci which extend anteriorly from the meso-metasternal suture. *sulci-sternus* sp. nov.  
Elytra without a sutural stria; mesosternum without sulci 7
7. Upper surface impunctate *humicola* Marseul (1856, p. 570)  
At least with pronotum punctate, this often very finely but always rather deeply so 8
8. First dorsal stria abbreviated, usually on basal third 9  
First dorsal stria complete, 14
9. Meso-metasternal disk coarsely or moderately coarsely punctate 10  
Meso-metasternal disk finely punctate, if at all 12
10. Metasternal disk coarsely punctate, excepting at middle where it is longitudinally impressed and more densely, very finely punctate. *tantillus* J. L. Le Conte (1853, p. 291)  
Metasternum without an impressed median area which is more finely and densely punctate than the rest of the disk 11

<sup>1</sup> *B. tantillus* has some elytral punctures, particularly those at apex, connected by very fine, short aciculations.

11. Pronotum more coarsely punctate laterally than at middle; elytra basally with a rather narrow, common, smooth space along the suture; epipleural fossette with a row of coarse punctures; pygidium coarsely, densely punctate; prosternal striae slightly divergent apically; metasternum closely, coarsely punctate *globulinus* Casey (1893, p. 560)  
 Pronotum a little more coarsely punctate medially than laterally; elytra without a smooth, basal, sutural area; epipleural fossette smooth; pygidium finely, rather closely punctate; prosternal striae slightly convergent apically; metasternum moderately, sparsely punctate anteriorly, the punctures becoming coarser posteriorly *debilitans* Casey
12. Marginal pronotal stria closely crenulate along the anterior margin 13  
 Marginal pronotal stria not crenulate along the anterior margin.  
*convergens* Schmidt (1896, p. 65)
13. Metasternal disk impunctate; elytra remotely punctulate; size smaller, length 0.88 mm. *crenulatus* sp. nov.  
 Metasternal disk sparsely, rather deeply punctulate; elytra sparsely punctulate, the punctures coarser along the suture; size larger, length 1.22 1.33 mm. *rugisternus* sp. nov.
14. Marginal elytral and first dorsal striae nearly parallel throughout their length; elytra minutely, obliquely rugose, except apically and extero-laterally *acuminatus* Casey (1893, p. 561)  
 Marginal elytral and first dorsal striae divergent basally, the basal interval twice as wide as the apical 15
15. Elytra moderately or rather coarsely punctate 16  
 Elytra punctulate 17
16. Metasternal disk punctate throughout, the punctures moderate and sparse anteriorly, becoming coarse posteriorly *debilitans* Casey  
 Metasternal disk with a few moderately coarse punctures medial to the meso-coxae and near apex *misellus* J. L. Le Conte (1853, p. 292)
17. Elytral punctures rather uniform; meso-metasternal disk smooth. *ferrugineus* Bickhardt (1918, p. 286)  
 Elytral punctures coarser on basal half along the suture; metasternum coarsely, shallowly, sparsely punctate *subcaninatus* Wenzel and Dybas

### Genus *Carcinops* Marseul

#### *Carcinops cribripuga* sp. nov.

*Type* from Key West, Florida. A male in the collection of the California Academy of Sciences.

*Paratypes*.—Three specimens from Florida; one each in the collections of Edward S. Ross, Field Museum, and the United States National Museum. One specimen from Jacksonville, Florida, in the collection of the United States National Museum.

*Description*.—Form somewhat elongate, oblong-oval, moderately convex. Color deep brownish-black, shining. Head finely, deeply, sparsely punctate, with finer punctulation intermingled. Marginal stria not extending beyond the eyes, completely absent in front.

Pronotum three-fourths as long as broad, sides nearly straight and feebly convergent on basal two-thirds, thence strongly arcuate and convergent to apical angles. Marginal stria complete, strongly impressed. Disk strongly, somewhat densely punctulate, coarser punctures intermingled on about each lateral third but inconspicuous along the margin. Basal margin rather strongly arcuate, with a row of strong, closely placed, elongate punctures. Antescutellar puncture round, well impressed, not very coarse.

Elytra together slightly broader than long, at humeri distinctly broader than pronotum; sides behind the humeri nearly straight and moderately converging to near apex, thence slightly arcuate. Surface rather densely punctulate throughout, extreme apices longitudinally strigoso-punctate. Marginal epipleural stria finely subcariniform, complete, very close to the margin apically; epipleural fossette rather coarsely, confluent punctate, apically with a rather irregular, subcariniform stria between the marginal epipleural and marginal elytral striae. Marginal elytral stria complete, deeply impressed, its outer edge coarsely subcariniform. Outer subhumeral stria complete or abbreviated at basal fourth; inner subhumeral stria complete, deeply impressed at base, fine apically. Dorsal striae one to five and sutural complete, the fifth and sutural united in a narrow arch; all the dorsal striae rather strongly crenate, one to five much more coarsely impressed basally than apically.

Propygidium coarsely, very densely punctate; pygidium similarly but a trifle more finely punctate.

Under surface, with the exception of the elevated sternal sides, micro-alutaceous, subopaque. Prosternal keel impunctate, dull; carinal striae rather coarsely cariniform, united basally, imperfectly united apically, sinuous at middle; prosternal lobe rather coarsely, closely punctate, without a marginal stria. Mesosternum coarsely punctate, its anterior margin feebly emarginate; marginal mesosternal stria entire, rather coarsely subcariniform, continuous with the lateral metasternal stria. Meso-metasternal stria absent, the suture represented by a smooth line. Metasternal disk rather densely punctulate, coarser punctures intermingled medial to the lateral striae. Lateral metasternal striae very coarsely impressed, the inner bending outwardly and extending about two-thirds the length of the metasternum, not reaching the posterior coxal cavity; outer lateral striae almost straight, oblique, extending nearly to middle.

First abdominal sternum coarsely bistrate on each side medial to the hind coxae, both striae reaching nearly to apex; disk at middle

with punctulation and moderate punctures intermingled, the larger punctures becoming noticeably coarse laterally near the striae.

Outer margin of protibiae bidentate, the teeth widely separated, the interval emarginate but not strongly so. Outer margin of mesotibiae with two distantly placed spinules, one a little beyond basal third, the other near apical fourth. Outer edge of metatibiae with a single spinule at about apical fourth. Outer faces of meso- and metatibiae longitudinally striolate.

*Measurements*.—Length 2.5–2.8; width 1.6–1.75 mm.

*Remarks*.—Since the middle and posterior tibiae of the type and paratypes are absent or in poor condition, it is possible that they normally have more spinules than have been indicated in the description. The species is related to *quattuordecimstriata* Stephens, *trogodytes* Paykull, and *assimilis* sp. nov.; it may be separated from them by the long external subhumeral stria, the strongly impressed union of the fifth and sutural striae, the character of the elytral punctation, and the cribrately punctate pygidia.

### ***Carcinops assimilis* sp. nov.**

*Type* from Satipo tropical rain forest, Department of Junin, Peru. A male in the collection of Field Museum of Natural History. Collected in November, 1935, by Felix Woytkowski, from a debris pile of *Atta* sp.

*Allotype*.—A female, same data as the type, in the collection of Field Museum.

*Paratypes*. Twenty specimens, same data as the type; two each in the collections of Edward S. Ross, the United States National Museum, and Field Museum, the remainder in the collection of Rupert L. Wenzel.

*Description*. Oblong-oval, subconvex. Color brownish-black, shining. Head with a complete stria. Front microscopically, sparsely punctate.

Pronotum nearly twice as broad as long. Sides feebly, subarcuately converging anteriorly. Marginal stria complete. Disk finely punctulate, with coarser punctures intermingled, the latter sparser in a rather narrow area along sides and at middle. Antescutellar impression deep, well defined.

Elytra nearly twice as long as, and at humeri distinctly broader than, pronotum; sides feebly, subarcuately converging to apex. Surface sparsely punctulate throughout. Epipleura near base with an

indication of two striae, the inner of which is represented apically by a row of fine punctures. Marginal stria subcariniform, extending around apex, thence obsolete. External subhumeral fine, abbreviated basally and apically; internal subhumeral complete. Five entire dorsal striae, these deeply impressed basally, becoming finer apically; striae punctate, the punctures rather coarse basally, becoming finer apically in conformity with the width of the striae; inner edges of striae evanescent so that the striae appear feebly subcariniform; fifth dorsal arching at base and recurving slightly; sutural nearly complete. Elytra, basally between suture and sutural stria, elevated so that the latter stria is apparently, not actually, complete and joined to the fifth.

Propygidium sparsely, finely punctate, punctures often poorly impressed, with sparse punctulation intermingled, general appearance rather smooth; pygidium sparsely punctulate.

Prosternum narrowed near middle, the striae fine, subcariniform, the interval between the striae flat or concave.

Anterior margin of mesosternum distinctly emarginate, the marginal stria complete, subcariniform and united with the lateral metasternal stria. Disk of mesosternum usually nearly smooth as in *C. troglodytes*, sometimes moderately sparsely punctate, with very fine punctures intermingled. Metasternum remotely punctulate.

Protibiae strongly arcuate, with several small, indistinct, closely placed teeth on basal half of outer margin; apical half with two conspicuous, rather widely separated teeth, the interval between the teeth emarginate. Middle and posterior tibiae each with two rather widely separated spines and a row of fine, hair-like spinules.

Length 2.2-5.45; width 1.35-1.65 mm.

*Remarks.* *C. assimilis* is closely allied to *troglodytes* and *14 striata*. From *C. troglodytes* it may be distinguished by its less strongly crenate dorsal elytral striae, the flattened or concave prosternal keel, the sparsely, more finely punctate propygidium, the simple punctation of the pygidium (punctulate only, no larger punctures intermingled), and the less distinctly punctate elytral apices.

### ***Carcinops densepunctata* sp. nov.**

*Type.*—Collected in New York in fiber of seed cotton from Ecuador, January 10, 1935. A male in the collection of the United States National Museum.



*Paratype.* A male, same data as the type, in the collection of Field Museum.

*Description.* Form oblong-oval, rather strongly convex. Color black, shining. Head very densely, finely punctate, the punctures deep and often confluent; marginal stria of head subcariniform, complete (in type) or interrupted at middle (paratype).

Pronotum twice as broad as long; sides nearly straight and moderately convergent on basal two-thirds, arcuate and strongly convergent on apical third. Marginal pronotal stria subcariniform, very fine and complete (in type) or narrowly interrupted at middle (paratype). Surface finely, irregularly alutaceous, and coarsely, rather shallowly, densely and subconfluently punctate, the punctures largest on each side in an area which extends from about lateral two-fifths to lateral fifth; along the margin the punctures are a little smaller and deeper; at middle near base in a roughly triangular area the punctures are sparser and shallower; minute punctures are scattered throughout.

Elytra together a little broader than long, at humeri distinctly broader than the pronotum; sides nearly straight and moderately convergent from humeri to near apex. Elytra moderately coarsely, deeply, densely punctate throughout, excepting the scutellar region which is punctulate; minute punctures intermingled; the punctures along the apices and near the suture about one-half the size of the discal punctures. Marginal elytral, external subhumeral, internal subhumeral, and dorsal striae one to five complete; sutural stria abbreviated at basal sixth; striae punctate, their inner margins indistinct and their outer margins feebly costiform; apices of the striae broken up into punctures; fifth dorsal stria arching over toward the suture; sutural stria sinuate near base.

Propygidium moderately coarsely, very densely punctate, with minute punctures intermingled. Pygidium similarly but more finely punctate, the punctures very fine at apex; pygidium strongly convex, the apical portion being at right angles to the basal portion.

Prosternal lobe immarginate, very finely, sparsely punctate. Prosternal keel punctulate, rather narrow, moderately convex between the striae, the striae sinuous and most widely separated apically, extending to the prosternal lobe. Mesosternum moderately coarsely punctate, the punctures separated by about their diameters, minute punctures intermingled; marginal stria coarse, complete; anterior mesosternal margin straight. Meso-metasternal suture distinct, not marked by a stria. Metasternum punctulate at middle,

the punctures becoming gradually larger laterally, coarse near the inner lateral metasternal stria; the latter is united anteriorly with the marginal mesosternal stria and extends posteriorly to the anterior margin of the hind coxal cavity; medial and parallel to lateral metasternal stria on each side is a moderately strong longitudinal impression which extends from basal third of metasternum to near apex. Elevated metasternal sides with two additional lateral metasternal striae, the outer one very short. Intercoxal disk of first abdominal sternum finely, sparsely punctate, bistriate on each side, the inner stria complete.

Outer margin of protibiae bidentate on apical half. Mesotibiae with six to eight spinules on basal two-thirds of outer margin, the spinules becoming progressively longer apically; well separated from this group of spinules are two or three large spinules near apex. Metatibiae with two or three spinules near middle of outer margin and two near apex.

Length 2.27-2.6; width 1.6-1.8 mm.

*Remarks.* *C. densepunctata* is easily distinguished from all other neotropical species of the genus by the dense, strong punctuation of the upper surface, the feebly costate outer edges of the elytral striae, and the long, numerous, stout spinules of the mesotibiae. The longitudinal metasternal impression present on each side medial to the inner lateral metasternal stria relates *densepunctata* to *schwarzi* sp. nov.

### ***Carcinops schwarzi* sp. nov.**

*Type* from Paraiso, Panama Canal Zone. A male in the collection of the United States National Museum. Collected from male flowers of *Attalea* palm, March 20, 1911, by E. A. Schwarz.

*Paratypes.* Thirty-two specimens from the type locality, collected from flowers of *Attalea* palm, March 20-April 2, 1911, by E. A. Schwarz; ten specimens, type locality, collected from flowers of *Iralia* palm, March 21, 1911, by A. H. Jennings. Paratypes in the collections of the United States National Museum, Field Museum, and Rupert L. Wenzel.

*Description.* Form oval, moderately convex. Color black, often with a tinge of brown, shining. Head deeply punctulate, with a few coarser punctures intermingled on front. Supraorbital stria complete, united with the frontal stria, which is subcariniform and extends on each side to the anterior margin, but is interrupted for the width of the epistoma.

Pronotum slightly less than twice as broad as long, sides nearly straight and convergent on basal two-thirds, more strongly arcuate and convergent on apical third. Marginal pronotal stria complete, well impressed. Surface sparsely, deeply punctulate throughout, with sparse, coarser punctures intermingled, the latter becoming coarser and denser near the sides.

Elytra together about one-fifth broader than long, sides slightly converging apically, arcuate at humeri and near apex, nearly straight at middle. Marginal epipleural and marginal elytral striae subcariniform, finely punctate, complete, the marginal elytral extending around the outer apical angle and about one-third across the elytral apex. External subhumeral stria fine, subcariniform, finely punctate, present on middle third or a little more; internal subhumeral and first and second dorsal striae deeply impressed, crenate, extending from base to apex; third, fourth, and fifth dorsal striae deeply impressed and crenate on basal half, but consisting of a row of moderately coarse punctures on apical half, the punctures fairly distinct from those of the elytral interstices; sutural stria crenate, consisting of punctures apically, crenate at middle, not joined to the fifth dorsal, abbreviated or consisting of one or two punctures on basal fourth. Dorsal interstitial spaces sparsely, not finely, deeply punctate on apical half; on basal half from the third dorsal stria to the suture the elytra are sparsely microscopically punctate; lateral to the third dorsal the punctures (though still sparse and fine) become distinctly coarser and deeper.

Propygidium rather coarsely, moderately, sparsely punctate, with very fine, deep punctures intermingled. Pygidium deeply punctulate throughout, with coarser, deep punctures intermingled on basal half; the coarser punctures about one-half the size of the coarse propygidial punctures.

Prosternal keel one-seventh to one-eighth the width of the prothorax, deeply punctulate; carinal striae subcariniform, deeply impressed, transversely united at base, feebly sinuate at middle, feebly convergent but not united anteriorly, extending on each side to the prosternal lobe, which is deeply punctulate and immarginate. Mesosternum sparsely, deeply punctulate, with a few moderately coarse punctures intermingled; anterior margin very feebly, broadly emarginate, marginal stria deep, complete, and continuous on each side with the lateral metasternal stria. Meso-metasternal stria present, complete, subcariniform, feebly arcuate, strongly crenate. Metasternum sparsely punctulate; medial to the lateral metasternal

stria on each side is a well-developed stria which extends nearly the entire length of the metasternum; lateral to the lateral metasternal stria on the elevated sides of the metasternum, is an oblique stria which is basally united with the lateral metasternal stria and extends to the metasternal margin. Intercoxal disk of first abdominal sternum punctulate, coarser punctures present laterally.

Protibiae bidentate on apical half, the teeth rather small and widely separated. Mesotibiae with two widely separated spinules, one behind the middle, the other near apex. Metatibiae with a small spinule on outer margin near apex.

Length 1.75-2.01; width 1.23-1.5 mm.

*Remarks.* *C. schwarzi* is apparently allied to *punctinotum* Lewis but differs from that species in terms of smaller size, a well-developed, though not complete, frontal stria, and different elytral punctation. Lewis's description of *punctinotum* is not adequate to characterize the species.

### ***Carcinops exigua* sp. nov.**

*Type* from Hamburg Farm, Reventazon, Limon, Costa Rica. A male in the collection of Field Museum of Natural History. Collected on drying wood of *Castillica costaricensis*, in 1932, by Ferdinand Nevermann.

*Paratypes.* Two males and one female from Pueblo Nuevo, Republic of Panama. Collected from rotten papaya stump, September 25, 1918, by James Zetek; a pair of these in the collection of the United States National Museum, a male in the collection of Rupert L. Wenzel.

*Description.* Form oval, moderately convex. Color varying from pale reddish-brown to black with a tinge of brown, surface shining. Head with supraorbital stria fine, complete, continuous on each side with the frontal stria which is broadly interrupted and does not extend to the clypeal region but only to the angle near the eye; front shallowly impressed; head rather sparsely punctulate, the punctures somewhat coarse in the region of the supraorbital stria.

Pronotum twice as broad as long; sides feebly arcuate from base to near apex, thence more strongly arcuate. Marginal pronotal stria fine, complete. Surface minutely, not densely, punctulate throughout, a rather broad area on each side with additional moderately coarse punctures which become fine near the lateral margin. Basal margin with a row of moderate punctures.

Elytra microscopically punctulate, together a little broader than long, sides evenly arcuate from base to apex. Marginal epipleural and marginal elytral striae complete. External subhumeral stria absent, the internal very slightly abbreviated apically. Dorsal striae one to five complete, strongly impressed, feebly punctate, fifth not arching over to the suture; sutural stria absent on a little more than basal third.

Propygidium moderately, sparsely punctate, with punctulation intermingled, the larger punctures about the same size as the coarser pronotal punctures. Pygidial punctation similar to that of propygidium but with the larger punctures a trifle finer.

Prosternum remotely punctulate; keel less than twice as long as broad (6:4), flat between the striae; carinal striae feebly sinuate at middle, transversely united at base, extending anteriorly to the prosternal lobe, the latter finely, sparsely punctate, with a marginal stria along the truncate apical margin, this stria absent laterally.

Mesosternum microscopically punctulate; anterior margin nearly straight, feebly, outwardly sinuate at middle; marginal stria complete, fine and subcariniform, continuous on each side with the inner lateral metasternal stria which extends posteriorly to the anterior margin of the metacoxal cavity. Metasternal disk microscopically punctate, and feebly, longitudinally impressed on each side within the inner lateral metasternal stria. Intercoxal disk of first abdominal sternum longitudinally bistrate on each side, its posterior margin rather deeply, broadly, arcuately emarginate in the male, straight in the female.

Protibiae with two teeth, the posterior one at middle of outer margin, the other one-fourth from apex. Mesotibiae with one or two fine spinules near apex, and one or two near middle; near base are a few fine setae. Outer margin of metatibiae sparsely fimbriate, with a single spinule near apex.

Length 1.36-1.7; width 0.97-1.23 mm.

*Remarks.* The character of the anterior mesosternal margin is sufficient to separate *erigua* from its allies. The emarginate apical margin of the first abdominal sternum in the male is not known to exist in any other described species.

### ***Carcinops plaumanni* sp. nov.**

*Type* from Nova Teutonia, Santa Catharina, Brazil. A male in the collection of Field Museum of Natural History. Collected in November, 1940, by Fritz Plaumann.

*Paratypes.* Five specimens, same data as the type, in the collection of Rupert L. Wenzel. Three specimens, same locality as the type, collected in May, 1941, by Fritz Plaumann, in the collection of Field Museum.

*Description.* Form elongate-oblong, parallel-sided, strongly depressed. Color black, shining. Marginal (frontal) and supraorbital striae of head complete, well impressed. Head strongly, sparsely punctulate, with sparse, coarser punctures intermingled on the vertex.

Pronotal sides straight and parallel on about basal two-thirds, thence arcuate and convergent to apical angles. Marginal stria complete and well impressed along the sides and around the anterior angles, continued along basal margin for a short distance on each side, absent behind the head. Disk microscopically punctulate, with coarser strong punctures intermingled in a broad lateral area.

Epipleura bistriate, the striae punctate, the interval between them with a row of strong, rather coarse punctures on apical two-thirds; the inner (marginal elytral) stria with an obtusely subcariniform outer margin. Subhumeral striae punctate, the outer present on middle third, the inner abbreviated at apical fourth and coarsely impressed at base. Dorsal striae one to five complete, first and second normally impressed and punctate, third and fourth impressed but with closely placed oblong punctures which are more apparent than striae grooves; one to four widened and deepened at base; fifth similar apically to the fourth, but basally without the widening and deepening and with the punctures more distant, the striae groove being completely absent at base. Sutural stria variable, nearly complete or abbreviated on basal fourth or third, consisting of a row of punctures which become finer and more distant on basal half of elytron.

Pygidia sparsely punctulate with coarse punctures intermingled, the latter rapidly disappearing on apical half of pygidium.

Prosternal lobe large, scarcely deflexed, its apex broadly truncate, with a very fine, punctate stria close to the margin; disk of lobe deeply, sparsely, finely punctate at middle, the punctures becoming larger laterally. Prosternal keel of moderate width, punctulate, the striae deeply impressed, a little more distant apically, sometimes imperfectly united across basal margin. Anterior mesosternal margin rather broadly, arcuately emarginate at middle; marginal stria well impressed, complete, continuous on each side with the inner lateral metasternal stria, which is strongly oblique and extends posteriorly to a point anterior to the outer edge of the hind coxa;

outer lateral metasternal stria short. Meso-metasternal suture not marked by a stria. Meso-metasternal disk remotely, microscopically punctulate, a few coarse punctures present on each side in front of the hind coxa. Intercoxal disk of first abdominal sternum bistriate on each side.

Tibiae not presenting any distinctive characters.

Length 2.04–2.47; width 0.95–1.33 mm.

*Remarks.*—This species resembles *misella* Marseul and *miserula* Marseul in the possession of a broadly interrupted marginal pronotal stria but is readily distinguished from either of these by its larger size, the superficial fifth dorsal and sutural striae and the presence of a fine, punctate marginal stria along the apex of the prosternal lobe.

### ***Carcinops tuberata* sp. nov.**

*Type* from Nova Teutonia, Santa Catharina, Brazil. A male in the collection of Rupert L. Wenzel, collected in October, 1940, by Fritz Plaumann.

*Description.*—Form elongate, oblong-oval, feebly convex, subdepressed. Color black, shining. Head strongly, rather sparsely punctulate, with coarser punctures intermingled posteriorly on the vertex, the latter with distinct tubercle at middle in front of the supraorbital stria. Marginal or frontal stria absent along the anterior margin of the epistoma, present laterally and continuous with the complete supraorbital.

Pronotal sides feebly arcuate and convergent from base to near anterior angles, thence more strongly arcuate. Marginal stria complete and strong laterally, broadly interrupted along the anterior margin (for less than the width of the head). Disk sparsely punctulate throughout, with coarser punctures intermingled (except at middle), these less noticeable along the lateral margins.

Elytra strongly, sparsely punctulate, the flanks a little more densely so, coarser punctures intermingled across apices. Epipleura with a very fine, basally abbreviated stria along the margin; medial to this is a second, complete, more strongly impressed stria; marginal elytral stria complete, running along the dorsal edge of the epipleura. Outer subhumeral stria represented by a short dash at middle; inner subhumeral abbreviated one-sixth from apex, coarsely impressed at base. Dorsal striae one to four complete, crenately punctate; first to third coarsely impressed basally, the fourth more shallowly so; fifth a little longer than the sutural, which extends slightly beyond the middle.

Propygidium sparsely punctulate, with coarser, sparse punctures intermingled; pygidium more densely punctulate apically, a few coarser punctures intermingled basally.

Prosternal lobe distinctly deflexed and rather evenly, broadly rounded, with a very strongly impressed, arcuate, apical marginal stria, the interval between the stria and the margin appearing somewhat thickened; disk of lobe with a micro-strigose ground sculpture and deeply, rather sparsely, moderately punctate. Prosternal keel of moderate width, carinal striae subparallel, sinuate at middle, feebly united across base. Anterior mesosternal margin broadly, shallowly emarginate at middle; marginal stria fine, subcariniform, complete, united posteriorly on each side with the inner lateral metasternal stria which is strongly punctate, strongly oblique, and extends posteriorly to a point near the outer edge of the metacoxa; outer lateral metasternal stria punctate, parallel to the inner, extending from postcoxal stria of mesocoxae to the metasternal-metepisternal suture. Intercostal disk of first abdominal sternum bistrate on each side, the inner stria complete and sinuate, the outer extending from hind margin of metacoxal cavity to posterior margin of sternum; surface sparsely punctulate, a few moderately coarse punctures intermingled on basal half.

Length 2.04; width 1.13 mm.

*Remarks.* The tuberculate head, the extensively punctate pronotum, and the strongly margined prosternal lobe distinguish *tuberosa* from *plaumanni*, *misella*, and *miserula*. In *plaumanni* the interval between the stria and the margin of the prosternal lobe is very narrow.

### Subfamily Tribalinae

#### Genus *Epierus* Erichson

The neotropical species of *Epierus* which possess an antescutellar pronotal impression form a very distinctive group and there is reason to believe that they should be regarded as constituting a separate genus; the male genital structures differ markedly from those of other New World species of *Epierus*. However, until more extensive studies can be made, they should be included in the old genus. Below are given records of two described species, descriptions of two new ones, and a key to the known species of the group.

#### *Epierus arciger* Marseul

*Epierus arciger* Marseul, Ann. Soc. Ent. Fr., (3), 1, p. 684, pl. 10, fig. 5, 1854.

British Guiana: Kamakusa, one specimen (A.M.N.H.).



***Epierus coproides* Marseul**

*Epierus coproides* Marseul, Ann. Soc. Ent. Fr., (3), 1, p. 682, pl. 10, fig. 5, 1854.

Colombia: Aracataca, Magdalena River, one specimen (M.C.Z.; collected by P. J. Darlington, Jr.).

***Epierus darlingtoni* sp. nov.**

*Type* from Barro Colorado Island, Panama Canal Zone. A male in the collection of the Museum of Comparative Zoology. Collected May, 1929, by P. J. Darlington, Jr.

*Allotype*.—A female, same data as the type, in the collection of the Museum of Comparative Zoology.

*Paratypes*.—Six specimens (four males and two females), same data as the type; three in the collection of the Museum of Comparative Zoology and three (including a pair) in the collection of Field Museum.

*Description*.—Form oval, moderately convex. Color black with a tinge of brown, strongly shining. Labrum with four setigerous punctures. Head rather deeply, somewhat closely punctulate; vertex broadly concave, prominent above the antennal insertions, supra-orbital stria complete; epistoma longitudinally impressed, more strongly so in the male, sides parallel; frontal suture not impressed; anterior margin of epistoma with a small setigerous tubercle at middle in the male, this absent in the female.

Pronotum microscopically punctulate throughout, with sparse fine punctures intermingled, the latter nearly absent at middle and most prominent laterally in a rather broad area (absent along the side margins). Marginal stria complete, strongly impressed. Antescutellar impression hastiform, its apex obsolete and distinguishable only in certain lights. Sides rather strongly arcuate and convergent from base to apex.

Elytra microscopically, sparsely punctulate. Epipleura with two punctate striae, the most dorsal of which (external subhumeral of authors) margins the upper edge of the epipleuron, the other well separated from the epipleural margin (marginal epipleural?), the interval between the two with a row of disconnected, coarse punctures apically. Oblique humeral stria barely discernible. Dorsal striae finely impressed and strongly, crenately punctate; first dorsal present on basal half or a little less, sometimes represented apically by a few disconnected punctures; second dorsal either complete or obsolete on

basal fourth or less; third dorsal usually abbreviated on basal fourth or fifth, sometimes nearly complete; fourth dorsal usually represented by a short dash or a few punctures at apex, sometimes absent; sutural abbreviated at about basal fifth.

Pygidia minutely punctulate; propygidium with rather sparse, coarse punctures intermingled; pygidium deeply, sparsely punctate, the punctures moderate basally and becoming gradually finer apically; in the female the pygidium is more strongly punctate throughout than in the male.

Prosternum punctulate; keel moderately broad, the carinal striae divergent anteriorly and posteriorly; lobe with a strong, complete marginal stria. Anterior mesosternal margin very feebly bisinuate, nearly straight; marginal mesosternal stria narrowly interrupted at middle, subcariniform, briefly separated posteriorly on each side from the outer lateral metasternal stria which extends arcuately outward but terminates a considerable distance from the metasternal-mesepimeral suture. Meso-metasternal stria strong, subcariniform, angulate and closely approaching the anterior mesosternal margin at middle, continuous posteriorly on each side with the inner lateral metasternal stria, which recurves anteriorly and extends to the metasternal-mesepimeral suture. Postcoxal stria (behind mesocoxae) poorly developed or absent. Metasternum with a band of coarse punctures across apex; elevated sides with a few coarse punctures. First abdominal sternum with a stria on each side medial to the hind coxa; the stria curves outwardly and posteriorly and then recurves anteriorly nearly to the suture between the first sternum and the metepimeron.

Protibiae with seventeen or eighteen minute spinules along outer margin. Meso- and metatibiae with two or three fine subapical spinules on outer edge.

Length 2.7-3.47; width 2 2.33 mm.

*Remarks.*—This species is allied to *hastatus* Marseul and may be separated from it by the characters given in the key.

***Epierus striatipygus* sp. nov. (fig. 11, a)**

*Type* from Aripo Valley, Trinidad, British West Indies. A male in the collection of the Museum of Comparative Zoology. Collected deep in a cave, April 19, 1935, by Neal A. Weber. Altitude 2,600 feet.

*Allotype.*—A female, same data as the type, in the collection of the Museum of Comparative Zoology.

*Paratypes*.—Sixteen specimens (eight males and eight females), same data as the type; eight each in the collections of the Museum of Comparative Zoology and of Field Museum. Eight specimens from Balandra Bay, Trinidad, collected in April and May, 1922, by L. R. Reynolds, in the collection of Field Museum.

*Description*.—Form oval, rather strongly convex. Color deep reddish-brown to black, strongly shining. Labrum with four setigerous punctures. Epistoma microscopically punctulate, its anterior margin with a minute, setigerous tubercle at middle in the male (absent in the female); vertex more strongly, sparsely punctulate than the epistoma. Frontal suture (between vertex and front on a level with the antennae) evenly, inwardly arcuate, impressed.

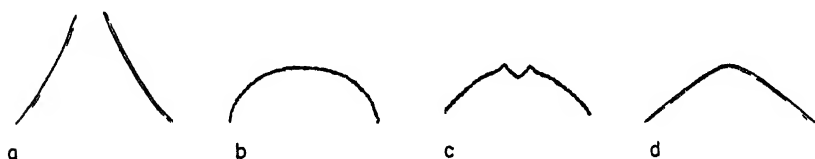


FIG. 11. Antescutellar pronotal impressions: a, *Epierus striatipygus* sp. nov.; b, *E. arciger* Marseul; c, *E. coproides* Marseul; d, *E. brasiliense* Tarsia in Curia.

Pronotum microscopically punctulate at middle, the punctures coarser, though still fine, in a broad lateral area; the coarser punctures are absent along the side margins. Marginal stria complete, well impressed. Antescutellar stria hastiform, well impressed, its extreme apex obsolete. Sides nearly straight and feebly convergent on basal half, arcuate and convergent on apical half.

Elytra microscopically punctulate throughout. Epipleura bistrigate, the striae subcariniform and finely, sparsely punctate, the interval between the striae with a row of disconnected, fine, deep punctures; the inner or most dorsal of these striae is that referred to by Marseul as the external subhumeral. Internal subhumeral stria very fine, variable, usually present on basal fourth and again on a little more than apical half, sometimes complete. Dorsal striae finely impressed and finely, sparsely punctate; dorsals one to three complete; fourth obsolete on basal fourth or third; fifth extending to middle; sutural stria generally abbreviated at basal third, sometimes barely extending beyond the middle.

Propygidium finely, strongly, sparsely punctate, the punctures about twice the size of the largest pronotal punctures. Pygidium finely, sparsely punctate, the punctures about the same size as the

coarsest on the pronotum, a few subapical punctures as coarse as those of the propygidium; not far removed from and parallel to the apical margin is an arcuate, punctate stria.

Prosternum punctulate; keel rather narrow, the carinal striae divergent anteriorly and posteriorly; lobe with a complete, strong, marginal stria. Anterior mesosternal margin nearly straight, marginal stria strong, not interrupted at middle. Meso-metasternal stria strong, subcariniform, feebly crenate, arcuate, not encroaching much upon the mesosternal disk, continuous on each side with the inner lateral metasternal stria which extends obliquely posteriorly to a point not far removed from the outer edge of the hind coxa. Metasternum with a postcoxal stria, which margins the posterior edge of the coxal cavity, and two lateral metasternal striae, the second or outer of which arises near the middle edge of the middle coxa and extends arcuately and transversely to a point not far removed from the mesepimeral-metasternal suture; the first or inner lateral stria is continuous with the meso-metasternal stria. In addition to these striae another extends posteriorly from the angle formed by the mesepimeron and the metepisternum nearly to the inner lateral metasternal stria. Sternal disks microscopically punctulate, elevated metasternal sides with a few moderate punctures (chiefly along the striae). First abdominal sternum with two longitudinal striae on each side medial to the hind coxae; the inner of these is straight and somewhat oblique and extends to the posterior margin of the sternum; the outer is arcuate and curves outwardly and posteriorly, without recurving anteriorly, and terminates about one-third from apex.

Protibiae rather short, distinctly expanded apically, the outer margin with eleven to thirteen spinules of which the apical four or five are strong, the basal spinules becoming minute. Outer margins of mesotibiae with spinules which become minute and setiform basally. Metatibiae with a few subapical spinules on outer edge.

Length 1.76-2.04; width 1.16-1.43 mm.

*Remarks.*-- This species is very closely allied to *schmidtii* and may be separated from it by the characters given in the key; both have protibiae whose shape and adornment approach the type found in *Phelister*, but lack tarsal grooves.

KEY TO THE NEOTROPICAL SPECIES OF *EPIERUS* WHICH POSSESS AN  
ANTESCUTELLAR PRONOTAL IMPRESSION

1. Antescutellar pronotal impression hastiform (fig. 11, *a*)... 2
- Antescutellar impression arcuate or broadly triangular (fig. 11, *b*, *c*, *d*).... 5

2. *Pygidium* with an arcuate subapical stria or sulcus . . . . . 3  
*Pygidium* without subapical stria or sulcus . . . . . 4
3. *Pygidium* rather coarsely, deeply punctate with the exception of a median, swollen, smooth area; an excavated, arcuate, subapical sulcus present; internal subhumeral stria represented by a short basal portion only, if at all . . . . . *schmidti* Wenzel and Dybas (1941, p. 446)  
*Pygidium* rather evenly, sparsely, finely punctate, with an arcuate, subapical stria; internal subhumeral stria usually interrupted and consisting of a short basal portion and a long apical portion, sometimes complete.  
*striatipygus* sp. nov.
4. *Pygidium* sparsely punctate; first dorsal stria obsolete apically, the second dorsal sometimes obsolete basally, the third usually abbreviated on basal fourth or fifth, the fourth dorsal absent or represented by a short dash or a few punctures apically, fifth dorsal absent; marginal mesosternal stria interrupted at middle; length 2.66–3.47 mm. . . . . *darlingtoni* sp. nov.  
*Pygidium* densely punctate; dorsal striae 1–4 complete, the fifth reaching the middle; marginal mesosternal stria complete; length 2.5 mm.  
*haslatus* Marseul (1854, p. 685)
5. Internal subhumeral stria complete . . . . . *epulo* Marseul (1870, p. 98)  
Internal subhumeral stria absent . . . . . 6
6. Antescutellar impression broadly triangular (fig. 11, d).  
*brasiliense* Tarsia in Curia (1935, p. 1)  
Antescutellar impression arcuate (fig. 11, b, c) . . . . . 7
7. Antescutellar stria angulately re-entrant at middle (fig. 11, c); inner lateral metasternal stria extending posteriorly, then recurving anteriorly and reaching the metasternal-mesepimeral suture.  
*coproides* Marseul (1854, p. 682)  
Antescutellar stria not re-entrant at middle (fig. 11, b); inner lateral metasternal stria extending obliquely posteriorly and terminating without recurving anteriorly . . . . . *arciger* Marseul (1854, p. 684)

### *Epierus cylindricus* sp. nov.

*Type* from Pinar del Rio, Cuba. A specimen of undetermined sex in the collection of Field Museum of Natural History. Collected by C. F. Baker.

*Paratypes*.—Two specimens, male and female, same data as the type, in the collection of Field Museum.

*Description*.—Form elongate, parallel-sided, subcylindrical, a little depressed along the middle, resembling a *Cylistosoma*. Color black, shining. Head somewhat densely punctulate. Labrum, across the middle, with a row of four setigerous punctures bearing long setae; posterior to these are about eight others which bear shorter setae. Frontal suture very fine.

Pronotal sides nearly straight, subparallel on basal half, strongly arcuate and convergent apically. Marginal stria complete. Surface sparsely, microscopically punctulate, with fine punctures inter-

mingled, these absent along the lateral margins and rather dense and coarser in a narrowly triangular antescutellar area.

Elytra microscopically, sparsely punctulate. Epipleura with two punctate subcariniform striae, of which the inner and more dorsal (external subhumeral of Marseul) is the coarser. Internal subhumeral stria represented by a feeble impression near the middle and (in the type) apically. Oblique humeral rather short, indistinct in one paratype. Dorsal striae one to five and sutural complete, rather closely, crenately punctate, very coarsely impressed.

Propygidium sparsely punctulate, with deep, moderately coarse, rather sparse punctures intermingled. Pygidium sparsely, microscopically punctulate, with rather fine, sparse punctures intermingled; the latter separated by about their diameters at middle along base and disappearing at apex, sparser and coarser laterally.

Prosternum deeply, sparsely punctulate; keel rather narrow, the striae strongly impressed, feebly divergent basally, more strongly divergent apically; lobe with a complete marginal stria. Anterior margin of mesosternum very feebly emarginate. Marginal mesosternal stria nearly straight, united posteriorly on each side with the lateral metasternal stria which is straight, oblique, punctate, and strongly subcariniform and extends posteriorly to the metasternal-metepisternal suture at a point immediately anterior to the metepisternal-metepimeral suture; another metasternal stria is also present, extending posteriorly from the angle formed by the junction of the metasternum, the mesepimeron, and the metepisternum and terminating at a point shortly removed from the lateral metasternal stria. Meso-metasternal suture visible, not represented by a stria. Meso-metasternal disks punctulate throughout, the punctures denser, deeper and coarser in a rather broad area on each side of the median line of the metasternum; elevated metasternal sides punctulate, with coarse, sparse punctures intermingled. First abdominal sternum on each side (medial to the metacoxae) with an oblique stria which extends from basal to apical margins; this stria is very coarsely impressed and subcariniform basally, becoming finer apically.

Outer margin of protibiae with eight or nine fine spinules. Mesotibiae with five or six spinules on outer edge, the metatibiae with two or three subapical spinules.

Length 1.9–2.4; width 1.04–1.17 mm.

*Remarks.*—This is the only species known to me that is parallel-sided and subcylindrical. Its form would obviously seem to be an adaptation to living in burrows, perhaps of scolytoids.

## Subfamily Histerinae

## Tribe Hololeptini

**Phylloma** Erichson (= *Platyentidium* Dillon)

*Phylloma* Erichson, Jahrb. Ins., 1, p. 96, 1834.

*Phylloma* Marseul, Ann. Soc. Ent. Fr., (3), 1, p. 191, 1853.

*Phylloma* Bickhardt, Gen. Ins., 166a, p. 24, 1916.

*Platyentidium* Dillon, Ann. Ent. Soc. Amer., 28, p. 463, 1935.

Dillon proposed the genus *Platyentidium* for two species described by him as new. Of these *williamsi* may be identical with *corticale* Fabricius, while *unistriatum* is probably a valid species. The genus was distinguished from *Phylloma* on the basis of differences of prosternal and tibial characters which do not actually exist but which were inaccurately figured by Marseul.

**Phylloma multispinosum** sp. nov. (pl. 2, fig. 3, *a*, *c*)

*Type* from Hamburg Farm, Reventazon, Limon, Costa Rica. A specimen of undetermined sex in the collection of Field Museum of Natural History. Collected from under loose bark of freshly cut wood, May 26, 1930, by Ferdinand Nevermann.

*Paratypes*.—A specimen of undetermined sex from the type locality, in the collection of Field Museum; collected May 2, 1930, by Ferdinand Nevermann. Two specimens, sex undetermined, from British Honduras, in the collection of the Museum of Comparative Zoology; collected April 18, 1906.

*Description*.—Size and form of *P. corticale* and apparently distinguishable from that species only in the structure of the tibiae.

Outer face of protibiae with one complete row and two incomplete rows of closely set, blunt spinules which are inserted at right angles to the face. Mesotibiae with three subapical rows of obliquely placed subconical spinules and several additional spinules along apical margin. Metatibiae similar to the mesotibiae but with a half row of spinules along apical margin and with only two subapical rows of closely placed spinules.

Length 5.80–6.75; width 3.23–3.80 mm.

*Remarks*.—In *corticale* the meso- and metatibiae have but a single subapical row of spinules and the protibiae have only a single row of spinules on the outer face (pl. 2, fig. 3, *b*, *d*). A series of forty specimens of *corticale* from Nova Teutonia, Santa Catharina, Brazil, exhibits no variation in the direction of the tibial structure found in

*multispinosum*. In one example of the latter the protibial spinules are so closely placed as to be nearly indistinguishable from one another.

***Hololepta (Hololepta) striaticeps* sp. nov.**

*Type* from Hamburg Farm, Reventazon, Limon, Costa Rica. A female in the collection of Field Museum of Natural History. Collected from under loose bark of freshly cut wood, July 20, 1931, by Ferdinand Nevermann.

*Paratype* from Toledo District, British Honduras. A male in the collection of the Museum of Comparative Zoology; collected October 15, 1906 (Peck).

*Description*.—Form and size of *H. curta* Marseul. Front distinctly, but rather broadly, shallowly impressed in the region of the transverse striae, the latter curved, well marked. A longitudinal interocular stria is present on each side medial to the eyes and extends anteriorly to the preocular spine; its outer edge is strongly, obtusely carinate.

Lateral pronotal margins distinctly but not strongly angulate a little before the middle. Marginal stria complete laterally, continued on each side along the basal margin for about a sixth of the width, absent along anterior margin. Sides rather broadly, moderately, shallowly punctate from base to apex.

Epipleura smooth. Subhumeral stria coarse, not crenate, abbreviated at basal sixth and shortly before apex. First dorsal stria well impressed, present on about basal third. Basal portion of second dorsal very short, about a third as long as the first dorsal; appendix present on a little less than apical third.

Propygidium bifoveolate apically, strongly in the type, feebly in the paratype; coarsely, broadly, sparsely punctate laterally, the punctures finer along the apical margin. Pygidium smooth on about apical fourth, elsewhere coarsely, strongly punctate, the punctures separated by their diameters or a little less.

Prosternum broad, lobe truncate.

Protibiae four-dentate, the two basal teeth very small. Meso- and metatibiae tridentate.

Length 6.5–6.65; width 3.6–3.7 mm.

*Remarks*.—This species and *curta* differ from all species of the subgenus *Hololepta* known to the writer in possessing long interocular striae, and in the extent and relative coarseness of the pro-



notal punctation. In *striaticeps* the pygidium is even and punctate throughout, with the exception of a very narrow apical smooth area. In *curta* the pygidium is impunctate and convex on basal third, elsewhere coarsely punctate. In a series of *curta* from Costa Rica, British Guiana, Trinidad, and Peru there is no tendency toward the type of punctation found in *striaticeps*, and the second dorsal stria (with one exception) is complete or very narrowly interrupted in one or two places; in one example the second dorsal is broadly interrupted, the apical appendix being limited to apical third.

**Hololepta (Leionota) insularis** sp. nov.

*Type* from Barro Colorado Island, Panama Canal Zone. In the collection of Field Museum of Natural History. A male collected April, 1924, by J. C. Bradley.

*Paratypes*.—Three males from the type locality; one in the collection of Field Museum, collected July 18, 1924, by Nathan Banks; one in the collection of the Museum of Comparative Zoology, collected June 26, 1924, by Nathan Banks; one in the collection of the American Museum of Natural History, collected November 12, 1923.

*Description*.—Size and form of *Leionota cerdo* Marseul. Mandibles long, basally rather broad and impressed above; tips abruptly, inwardly bent. Head broad, preocular spines well developed. Front without transverse striae; interocular stria short, poorly defined.

Pronotum about three-fifths as long as broad; sides impunctate, obtusely angulate a little before middle and rather strongly sinuate near apex; apical angles broad, transverse, subtruncate. Marginal stria absent behind the head, complete laterally and extending inwardly along basal margin on each side for about a sixth of the width; it is deeply excavated in the shape of an inverted U around the anterior angles.

Epipleura smooth. Subhumeral stria coarse, not crenate, a little abbreviated basally and apically. First dorsal stria well impressed, present on basal fourth. Second dorsal stria strong, complete or very narrowly interrupted in one or two places near the middle.

Propygidium coarsely, densely punctate along the sides, the punctures becoming fine anteriorly and at middle of apical margin. Pygidium not margined (except indistinctly at lateral angles), cribrately, moderately coarsely punctate, the punctures about half the size of the coarsest propygidial punctures.

Mentum finely carinate in the form of a large inverted W. Anterior half of prosternal keel very narrow; prosternal lobe rather narrowly rounded.

Protibiae three- or four-dentate. Meso- and metatibiae with the upper ridge strongly, the lower ridge feebly and bluntly, three-dentate.

Length 8.2-9.2; width 4.4-4.9 mm.

*Remarks.*—Although females of *insularis* are not known, they will probably be found to have shorter, non-impressed mandibles and to lack the excavations around the anterior pronotal angles, as do females of the allied species *intersectum* Lewis and *cerdo*. The following characters may be used to distinguish between *insularis* and *cerdo*:

<i>cerdo</i>	<i>insularis</i>
Marginal pronotal stria interrupted at lateral angulations.	Marginal pronotal stria complete and well impressed along sides.
Pronotal sides straight, though convergent, before apex.	Pronotal sides sinuate before apex.
Propygidium cribrately punctate at sides, punctures very coarse.	Propygidium not cribrately punctate at sides, punctures coarse.

### Tribe Histerini

#### Genus *Margarinotus* Marseul

This genus has previously been limited to two species, namely, the palaearctic *scaber* Fabricius and the nearctic *guttifer* Horn. A study of the male aedeagus shows,<sup>1</sup> however, that the generic limits must be considerably extended to include the species placed in *Paralister*, *Grammostethus*, *Stenister*, and the *cadaverinus-foedatus* groups of the genus *Hister*. The last-named genus contains widely divergent groups which must be given generic status at some future date. A revision of the species of *Margarinotus* is in preparation, but inasmuch as it will not be completed for some time, descriptions of some of the new species are given here in order to fix the types which have already been designated. The species are predominantly holarctic in distribution, a few being known from the Oriental and Indo-Australian regions.

<sup>1</sup> The aedeagus of *scaber* has not been examined by the writer, but Dr. Edward S. Ross has kindly informed the writer that it is of the same type found in *guttifer* (pl. 6, fig. 1). Credit is due Dr. Ross for first noting that the aedeagus of these two species relates them to others which the writer assigns to *Margarinotus* in the following pages.

**Margarinotus** Marseul

*Margarinotus* Marseul, Ann. Soc. Ent. Fr., (3), 1, p. 549, 1853.

*Grammostethus* Lewis, Ann. Mag. Nat. Hist., (7), 18, p. 400, 1906.

*Paralister* Bickhardt, Gen. Ins., 166a, p. 188, 1916.

*Stenister* Reichardt, Rev. Russe Ent., 20, p. 270, 1926.

Genotype *Margarinotus scaber* Fabricius.

*Diagnosis*.—Frontal and supraorbital striae present, the frontal sometimes obsolescent. Anterior pronotal margin emarginate for the reception of the head. One or two lateral pronotal striae present, the outer frequently abbreviated when present. External subhumeral stria nearly always complete, occasionally abbreviated or obliterated; internal subhumeral stria absent, though a few punctures may occasionally be present apically. Dorsal striae well impressed, excepting in *scaber* and *guttifer*. Prosternal keel seldom striate, the striae when present usually rudimentary. Anterior margin of mesosternum usually emarginate, occasionally truncate (*darvsi*) or nearly so. Protibiae with four to sixteen denticles or teeth.

Aedeagus with a ring-shaped articulating basal piece; the rest of the tegmen variable, either bifid apically on dorsal surface (pl. 4, figs. 1, *b*, 2, *b*) or tetrafid (pl. 5, figs. 1, *b*, 2, *b*). Median lobe sclerotized, subcylindrical (pl. 8, figs. 2, 3; pl. 9), or spoon-shaped (text fig. 12, *b*; pl. 6; pl. 7; pl. 8, fig. 1), with paired posterior apodemes (text fig. 12, *b*; pl. 7, fig. 4; pl. 8, fig. 2, *b*); gonopore distal. Median armature connected to the base of the median lobe by a sclerotized hinge or by a heavy membrane; median armature, when viewed from above, nearly always forked apically (pl. 7, fig. 4; pl. 9, fig. 1, *b*), the forks sometimes fused.

*Remarks*.—The median lobe and armature are connected to the tegmen by a common, loose, diaphragmatic membrane which arises from the inflexed anterior and dorsal margins of the tegmen. The median lobe is extruded by the contraction of paired muscles, whose origin is in a somewhat fan-shaped band on the inner antero-lateral face of the tegmen on each side, and which narrow to their insertion on the posterior apodemes of the median lobe. As the lobe is extruded, the median armature rotates upwardly (text fig. 12, *c*) and probably functions as a mechanism for holding the aedeagus in the copulatory bursa of the female. In some species which have a tetrafid tegmen, a cylindrical median lobe, and a more or less reduced median armature, the last-named structure serves to spread the finger-like dorsal tegminal lobes upwardly and outwardly for the same function.

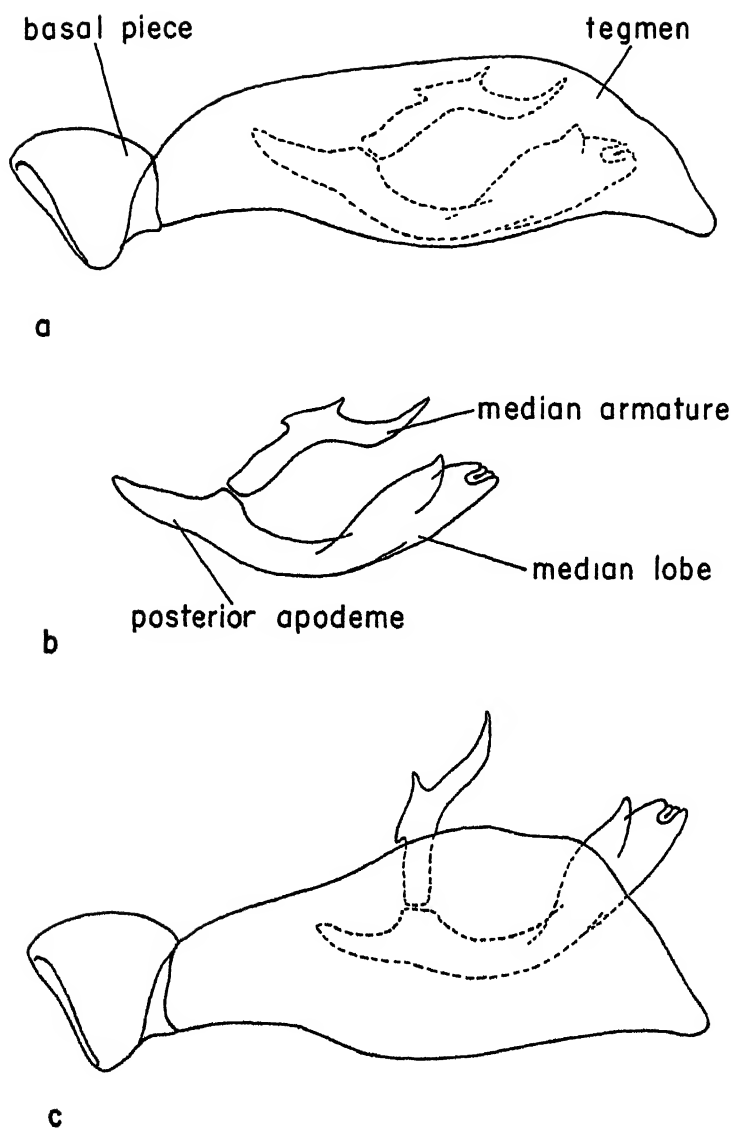


FIG. 12. Aedeagus of *Margarinotus cadaverinus* Hoffmann. a, Lateral view; sclerotized internal structures indicated by dotted lines. b, Lateral view of sclerotized internal structures (median lobe and median armature). c, Lateral view with median lobe extruded and median armature rotated upwardly.

The females of many closely allied species cannot be identified except by association with the males or in conjunction with extensive reference collections.

The following species are placed in *Margarinotus* as defined above; there may be a few other described forms which, unknown to the writer, must be included. Names preceded by a question mark are only tentatively included because they have not been examined by the writer and their status is doubtful. The genus or subgenus to which each species had last been assigned is indicated in parentheses.

- adonis* Blatchley (*Atholus*)  
*aenigmaticus* Wenzel (*Hister*)  
*arrosor* Bickhardt (*Hister*)  
*ballou* sp. nov.  
*bickhardti* Reitter (*Stenister*)  
*bipustulatus* Schrank (*Paralister*)  
*boleti* Lewis (*Hister*)  
*bueckingi* Bickhardt (*Paralister*)  
*cadavericola* Bickhardt (*Hister*)  
*cadaverinus* Hoffmann (*Hister*)  
*(?)californicus* Marseul (*Paralister*)  
*carbonarius* Illiger (*Paralister*)  
*cognatus* Le Conte (*Paralister*)  
*confusus* sp. nov.  
*curvicolis* Bickhardt (*Grammostethus*)  
*davisi* Schaeffer (*Atholus*)  
*distinctus* Erichson (*Hister*)  
*ednae* Carnochan (*Hister*)  
*egregius* Casey (*Hister*)  
*(?)faldermanni* Marseul (*Hister*)  
*felipae* Lewis (*Hister*)  
*fidelis* Casey (*Hister*)  
*fractifrons* Lewis (*Hister*)  
*fractistrius* Lewis (*Grammostethus*)  
*fragosus* Lewis (*Grammostethus*)  
*gentilis* Lewis (*Hister*)  
*graecus* Brullé (*Paralister*)  
*guttifer* Horn (*Margarinotus*)  
*hailar* sp. nov.  
*hamatilis* Lewis (*Grammostethus*)  
*ignobilis* Marseul (*Paralister*)  
*immunis* Erichson (*Hister*)  
*impiger* Lewis (*Grammostethus*)  
*incognitus* Marseul (*Hister*)  
*indicus* Lewis (*Grammostethus*)  
*indicolica* Desbordes (*Hister*)  
*integer* Brisout (*Hister*)  
*interruptus* Beauvois (*Hister*)  
*koenigi* Schmidt (*Paralister*)  
*kolzei* Schmidt (*Hister*)  
*kurdistanus* Marseul (*Hister*)  
*laevifossa* Marseul (*Paralister*)  
*lecontei* sp. nov.  
*(?)litus* Marseul (*Paralister*)  
*longus* Bickhardt (*Paralister*)  
*marginatus* Erichson (*Grammostethus*)  
*marginicollis* Le Conte (*Paralister*)  
*marginipunctatus* Lewis (*Grammostethus*)  
*merdarius* Hoffmann (*Hister*)  
*mormon* Casey (*Hister*)  
*multidens* Schmidt (*Hister*)  
*navus* Marseul (*Grammostethus*)  
*neglectus* Germar (*Paralister*)  
*niponicus* Lewis (*Grammostethus*)  
*oblitus* Casey (*Hister*)  
*oblongulus* Schmidt (*Hister*)  
*occidentalis* Lewis (*Grammostethus*)  
*planiceps* Lewis (*Grammostethus*)  
*planifrons* Lewis (*Hister*)  
*pluto* Casey (*Hister*)  
*(?)punctiventer* Marseul (*Paralister*)  
*purpurascens* Marseul (*Paralister*)  
*rectus* Casey (*Hister*)  
*remotus* Le Conte (*Paralister*)  
*ruficornis* Grimmer (*Grammostethus*)  
*scaber* Fabricius (*Margarinotus*)  
*sinensis* Lewis (*Grammostethus*)  
*sinuaticollis* Lewis (*Grammostethus*)  
*sinuosus* Lewis (*Paralister*)  
*socius* Lewis (*Grammostethus*)  
*sodalis* Lewis (*Grammostethus*)  
*stenocephalus* Lewis (*Grammostethus*)  
*stercorarius* Hoffmann (*Paralister*)  
*stercoriger* Marseul (*Grammostethus*)  
*striola* Sahlberg (*Hister*)  
*striolides* sp. nov.  
*stygius* Le Conte (*Hister*)  
*terricola* Germar (*Hister*)  
*tristriatus* sp. nov.  
*umbilicatus* Casey (*Hister*)  
*umbratilis* Casey (*Hister*)  
*umbrosus* Casey (*Hister*)  
*uncostratus* Marseul (*Paralister*)  
*ussuriensis* Reichardt (*Hister*)  
*ventralis* Marseul (*Paralister*)  
*weymarni* sp. nov.

**Margarinotus hailar** sp. nov.

*Type* from Hailar, Barga Upland, Heilunkiang Province, North Manchuria. A male in the collection of Field Museum of Natural History. Collected in August, 1939, by A. Loukashkin.

*Description.*—Form oblong-oval. Frontal stria of head complete, straight at middle. Marginal pronotal stria abbreviated at basal third and broadly interrupted behind the head. Outer lateral pronotal stria close to the margin, complete laterally; inner lateral pronotal stria complete laterally and behind the head, sinuate at middle on the sides.

Epipleural fossette with a row of punctures along each margin. Transverse subapical elytral impression feeble. External subhumeral and dorsal striae one to four complete; fifth dorsal without basal rudiment, almost reaching the middle; sutural stria more strongly crenate than the others, abbreviated at basal third.

Pygidia with feebly alutaceous ground sculpture. Propygidium coarsely, rather sparsely punctate, the punctures fine along apical margin; minute punctures scattered throughout. Pygidium moderately coarsely, sparsely punctate, the punctures becoming finer apically, minute at apex.

Prosternal lobe rounded at apex, marginal stria interrupted. Anterior margin of mesosternum rather shallowly emarginate, marginal stria complete. Lateral metasternal stria subcariniform, feebly crenate, extending obliquely posteriorly for about half the length of the metasternum. The oblique stria which usually extends medially from the metasternal-metepisternal suture is lacking. No coarse punctures are present medial to the lateral metasternal stria.

Protibiae with four evenly separated denticles on outer margin; apical margin with one minute denticle.

Length 4.5; width 3.2 mm.

*Remarks.*—This species is allied to *kolzei* Schmidt but the latter has more densely and more coarsely punctate pygidia, three complete dorsal striae, five denticles on the outer margin of the protibiae, and on the elevated metasternal sides an oblique stria which extends medially from the middle of the metasternal-metepisternal suture.

**Margarinotus weymarni** sp. nov. (pl. 4, fig. 2; pl. 6, fig. 3)

*Type* from Erhtaohotze, Kirin Province, North Manchuria. A male in the collection of Field Museum of Natural History. Collected by A. Loukashkin, September 2–8, 1939.

*Paratypes*.—North Manchuria: thirty-five specimens, same data as the type. Thirty-three from Hsiolin Station, sixty miles west of Harbin, Kirin Province; collected July 10–25, 1938 (Michael Weymarn). Eighteen from Hsiaoling, Kirin Province; collected August, 1938 (A. Loukashkin). Seventeen from Weishaho, Kirin Province; collected August, 1938 (A. Loukashkin). One from Hailar, Barga Upland, Heilunkiang Province; collected August, 1938 (A. Loukashkin). Fifty-two from Chalantun (Djalantun), Greater Khingan Mountains, Heilunkiang Province; collected May, 1934, and June, 1938 (M. Weymarn). Thirty-five from Cheng-Chin, Lesser Khingan Mountains, Heilunkiang Province; collected June 16–22, 1938 (A. Loukashkin).

Japan: six specimens from Mashike. One from Nikko, collected July 17, 1931 (L. Gressitt).

The Japanese specimens are in the collection of Field Museum. Of the other paratypes, seventy-five representing all localities are in the collection of Field Museum; the remainder are in the collection of Rupert L. Wenzel.

*Description*.—Almost identical with *cadaverinus* Hoffmann in external characters but differing in the following respects:

A shallow impression is present basally in the region of the third and fourth dorsal elytral striae. Pygidia very densely punctate and more coarsely so than in *cadaverinus*. Lateral metasternal stria extending obliquely posteriorly for about two-thirds the length of the metasternum, not united with the strong stria which extends obliquely and medially from a point near the middle of the metasternal-metepisternal suture; metasternum with a narrow band of coarse punctures medial and approximate to the lateral metasternal stria.

Length 5.52–7.5; width 4.1–5.7 mm.

*Remarks*.—This is probably the species on which Manchurian, Chinese, and Japanese records of *cadaverinus* have been based. The prosternal lobe is typically truncate at apex with the marginal stria interrupted, but occasionally the margin is rounded and sometimes the marginal stria is complete. In a few examples the outer lateral pronotal stria is narrowly interrupted at middle. The conformation of the median armature varies somewhat, but not sufficiently to make identification questionable.

In *cadaverinus* there is no band of coarse punctures along the inner margin of the lateral metasternal stria and the latter is continuous with the oblique stria mentioned in the description.

**Margarinotus balloui** sp. nov. (pl. 6, fig. 2)

*Type* from Nikko, Japan. A male in the collection of Field Museum of Natural History. Collected July 19, 1931, by L. Gressitt.

*Description.* Form oblong-oval. Frontal stria of head narrowly interrupted at middle. Marginal pronotal stria complete; outer lateral stria complete along the sides, feebly hooked apically; inner lateral stria complete laterally and behind the head, terminating basally in an irregular striole on the one side and in a series of elongate punctures on the other.

Subapical impression of elytra very feeble, basal impressions in the region of the third and fourth dorsal striae not present. Epipleural fossette sparsely punctate at middle. External subhumeral stria complete. Dorsal striae one to four complete; fifth and sutural striae represented by a series of connected punctures, the fifth a little shorter than the sutural and represented at base by a short arc; sutural present on apical half. Pygidial punctation as in *cadaverinus*.

Prosternal lobe truncate at apex, the marginal stria interrupted. Anterior margin of mesosternum feebly emarginate, marginal stria complete; lateral metasternal stria extending obliquely posteriorly and continuous with the transverse oblique stria which extends medially from the metasternal-metepisternal suture; inner edge of lateral metasternal stria with a row of coarse punctures.

Outer margin of protibiae arcuate, bearing seven or eight small denticles, of which the basal two or three are minute; teeth of apical margin not discernible in the type though they probably normally exist.

Length 5.6; width 4.1 mm.

*Remarks.* The writer is unable to separate *balloui* from *cadaverinus* on the basis of external characters; however, the median armature of the male aedeagus is very distinct and somewhat approaches that of *stycticus* Le Conte from eastern North America.

**Margarinotus striolides** sp. nov. (pl. 7, fig. 1)

*Type* from Tunkun, Sajon Mountains, Siberia. A male in the collection of Field Museum of Natural History.

*Paratypes.*—A male from Weishaho, Kirin Province, North Manchuria, collected in August, 1938 (A. Loukashkin). A male from Cheng-Chin, Lesser Khingan Mountains, Heilunkiang Province, North Manchuria, collected June 16-22, 1938 (A. Loukashkin). Both in the collection of Rupert L. Wenzel.



*Description.*—Form oblong-oval. Frontal stria complete and feebly, inwardly angulate at middle. Marginal pronotal stria interrupted behind the head. Outer lateral pronotal stria abbreviated on basal fourth or less, hooked at apex. Inner lateral stria complete laterally and behind the head.

Elytra with a transverse subapical impression and an impression at the base of the third dorsal stria. Epipleural fossette densely punctate. External subhumeral stria complete. Dorsal striae one to four complete; fifth and sutural striae subequal and present on apical half or a little less, the fifth without a basal rudiment.

Pygidial punctation dense, a trifle finer than that of the propygidium excepting laterally; apex more finely and sparsely punctate, without alutaceous ground sculpture.

Prosternal lobe rounded, marginal stria complete. Anterior margin of mesosternum distinctly (not feebly) emarginate; marginal mesosternal stria complete. Lateral metasternal stria extending obliquely posteriorly, not united with the oblique stria, which extends medially from the middle of the metasternal-metepisternal suture. Metasternal disk with a narrow band of moderate or fine punctures medial to the lateral stria.

Protibiae with two fine denticles on apical margin and five or six denticles on outer margin, the basal one very fine.

Length 5.5–5.78; width 3.8–4 mm.

*Remarks.*—This species is probably the one on which the far eastern records of *striola* have been based; in the latter species the pygidium is more finely and densely punctate. The median lobe and armature of the aedeagus of both species are shown in pl. 7, figs. 1, 2. In the Cheng-chin specimen, the propygidium is more sparsely punctate than in the other two.

**Margarinotus tristriatus** sp. nov. (pl. 3, fig. 1; pl. 7, figs. 3, 4)

*Type* from Yalu Station, Greater Khingan Mountains, Heilunkiang Province, North Manchuria. A male in the collection of Field Museum of Natural History. Collected September 20–October 5, 1939, by A. Loukashkin.

*Description.*—Form oblong-oval, humeri somewhat inflated. Frontal stria of head narrowly re-entrant at middle.

Marginal pronotal stria interrupted behind the head, complete laterally. Outer lateral pronotal stria broadly interrupted at middle along the sides (absent on middle third), hooked at apex; inner lateral

pronotal stria complete, feebly punctate, irregular along the sides, and more widely separated from the lateral margin anteriorly than posteriorly, its posterior end nearly in contact with the basal portion of the outer lateral stria. Sparse, moderately coarse punctures are present near the posterior end of the inner lateral stria and within the hook of the outer lateral stria.

Elytra with a strong, transverse subapical impression and an impression at the base of the third dorsal stria. Epipleural fossette densely punctate. External subhumeral stria and dorsals one to three complete; fourth and fifth dorsals represented by apical rudiments, sutural present on apical half; basal rudiment of the fifth represented by two rather widely separated, coarse punctiform impressions.

Propygidium coarsely and rather sparsely punctate along the sides and base, becoming finer apically, particularly at middle; a few minute punctures are intermingled in the area of coarse punctation. Pygidial disk rather evenly, finely, sparsely punctate, the punctures coarser laterally, minute at apex.

Prosternal lobe rather narrowly rounded at apex, marginal stria complete. Anterior margin of mesosternum distinctly (not feebly) emarginate. Marginal mesosternal stria complete; meso-metasternal suture not marked by a stria; the lateral metasternal stria extends posteriorly to, but is not continuous with, the oblique stria which extends medially from the middle of the metasternal-metepisternal suture.

Protibiae with eight teeth along outer margin (the two basal teeth minute); two minute teeth present along apical margin.

Length 7; width 4.8 mm.

*Remarks.*—The interrupted outer lateral pronotal stria may be an aberration. Bickhardt's *arrosor* seems to be related but may be separated by the characters given in the key.

The following key will aid in separating the preceding new species from their far eastern allies, i.e. the species with two lateral pronotal striae.

1. Elytra with three entire dorsal striae . . . . . 2  
    Elytra with four entire dorsal striae . . . . . 6
2. Inner lateral pronotal stria strongly bent behind the eyes; dorsal elytral striae strongly crenate. Length 7 mm. . . . . *boleti* Lewis (1884, p. 135)  
    Inner lateral stria without a strong angulation behind the eyes; dorsal elytral striae slightly or not at all crenate . . . . . 3
3. Marginal pronotal stria complete along the sides and attaining the base . . 4  
    Marginal pronotal stria abbreviated on basal half or third . . . . . 5

4. Outer lateral pronotal stria abbreviated anteriorly and posteriorly; propygidium densely, pygidium very densely punctate; body form elongate, subparallel, somewhat depressed . . . . . *oblongulus* Schmidt (1892, p. 24)  
Outer lateral pronotal stria complete; propygidium and pygidium moderately, coarsely, densely punctate, the pygidial punctures separated by about half their diameters; form oblong-oval. Median lobe as in pl. 8, fig. 2, *a*, *b* . . . . . *kolzei* Schmidt (1889, p. 369)
5. Fourth and fifth dorsal striae without basal rudiments;<sup>1</sup> pronotum with moderate punctures around the base of the inner lateral stria and within the apical hook of the outer lateral stria, the last-named stria interrupted on middle third (aberration?); anterior margin of mesosternum rather deeply emarginate at middle; median lobe as in pl. 7, fig. 3, *a*, *b*.  
*tristriatus* sp. nov.  
Fourth and fifth dorsal striae with basal rudiments; pronotum impunctate; outer lateral stria complete; anterior margin of mesosternum feebly emarginate . . . . . *arrosor* Bickhardt (1920a, p. 99)
6. Protibiae with 12–16 denticles . . . . . *multidens* Schmidt (1889, p. 94)  
Protibiae with 4–7 denticles . . . . . 7
7. Fifth dorsal stria with a basal rudiment . . . . . 10  
Fifth dorsal stria not represented basally by a rudiment . . . . . 8
8. Marginal pronotal stria abbreviated on basal half or third; outer lateral pronotal stria close to the margin . . . . . 9  
Marginal pronotal stria complete along the sides and attaining base; outer lateral stria more distant from the margin; epipleural fossette coarsely and moderately densely punctate . . . . . *striolides* sp. nov.
9. Epipleural fossette impunctate; pygidia very densely punctate; outer lateral pronotal stria abbreviated anteriorly and posteriorly (sometimes reduced to a dash near middle or absent) . . . . . *koenigi* Schmidt (1888, p. 189)  
Epipleural fossette with a row of punctures along inner and outer edges; pygidia rather sparsely punctate; outer lateral pronotal stria complete.  
*hailar* sp. nov.
10. Dorsal elytral striae strongly crenate; interval between the lateral pronotal striae usually with numerous moderate punctures, these rarely absent, sometimes extending from apex to base, nearly always present near the apical angles, and frequently present on the disk medial to the inner stria; median lobe and armature of aedeagus as shown in pl. 8, fig. 1.  
*ussuriensis* Reichardt (1929, p. 285)  
Dorsal elytral striae moderately or feebly crenate; interval between the lateral pronotal striae at most with strong punctuation or fine punctures . . . . 11
11. Posterior margin of propygidium smooth.  
*cadavericola* Bickhardt (1920a, p. 102)  
Propygidial punctures extending to the hind margin . . . . . 12
12. Lateral metasternal striae extending to, but not united with, the oblique stria which extends medially from the middle of the metasternal-metepisternal suture; median lobe and armature as shown in pl. 6, fig. 3.  
*weymarni* sp. nov.  
Lateral metasternal stria continuous with the oblique stria; median lobe and armature as shown in pl. 6, fig. 2 . . . . . *balloui* sp. nov.

<sup>1</sup> The fifth is represented at base by two strongly punctiform impressions but not by a stria; similar variants are known in other species which normally have no basal rudiments.

**Margarinotus confusus** sp. nov. (pl. 9, fig. 3)

*Hister (Paralister) marginicollis* Wenzel, Can. Ent., 68, p. 270, 1936.

*Type* from Joliet, Illinois. A male in the collection of Field Museum of Natural History. Collected in fungus, March 23, 1935, by Frank Schuett.

*Paratypes*.—Illinois: A pair, same data as the type. One from Evanston, collected in fungus, March 28, 1933 (J. Robinson). One from Kankakee, collected April 25, 1936 (Janet Wilder).—Indiana: One from Turkey Run, collected April 2, 1925. One from Marion County, collected March 13, 1910 (W. S. Blatchley).—Pennsylvania: One from Jeannette, collected in July (H. G. Klages).—New York: One from Central Park, Long Island, collected April 11, 1935.—Massachusetts: Six from Natick, collected in a fox hole, May 4–11, 1941 (C. A. Frost). One from Framingham, collected April 18, 1915 (C. A. Frost).

*Description*.—Form oblong. Frontal stria of head deep, straight or feebly and narrowly bowed inward at middle. Marginal pronotal stria complete laterally, broadly interrupted behind the head. Outer lateral stria absent; inner lateral stria complete, crenate behind the head, strong and usually sinuate along the sides, the interval between it and the margin somewhat convex. Disk with a few moderate to moderately coarse punctures medial to the lateral stria.

Epipleura finely margined. Marginal elytral stria complete, well impressed, its outer edge strongly subcariniform. On apical half, between the marginal elytral and the marginal epipleural striae, is a poorly impressed coarse stria; epipleural fossette moderately to moderately coarsely, deeply, and sparsely punctate. External sub-humeral stria complete, well impressed. Dorsal striae one to three complete; fourth dorsal variable, usually abbreviated at basal fifth, occasionally at basal fourth or third; fifth dorsal variable, usually present on apical third, sometimes extending to middle. Sutural stria usually extending slightly beyond the middle, occasionally to basal third. Dorsal striae usually not noticeably punctate.

Pygidia micro-alutaceous, the pygidium usually more feebly so; propygidium sparsely, moderately coarsely punctate, a few minute punctures intermingled; pygidium similarly but a little more finely punctate, the punctures minute apically.

Prosternum micro-alutaceous; keel sparsely punctulate, often with fine rudimentary carinal striae between the coxae; lobe sparsely punctulate at middle, coarsely punctate laterally, its marginal stria

deep, sometimes interrupted at middle. Anterior margin of mesosternum feebly emarginate; marginal stria complete, strongly punctate. Meso-metasternal stria usually complete, sometimes almost entirely absent, continuous on each side with the lateral metasternal stria which extends obliquely posteriorly nearly to the oblique stria which extends inwardly and posteriorly from the metasternal-metepisternal suture.

Protibiae with five or six denticles externally, the basal two minute; truncate apical margin with two minute denticles.

Length 3.5–3.9; width 2.5–2.8 mm.

*Remarks.*—Upon examining a fairly large series of specimens which had been determined as *marginicollis* Le Conte, the writer found that two very closely allied species were represented. Since the only definite character by which they can be separated is the structure of the median lobe and armature of the aedeagus, the question naturally arises as to which is the Le Conte species. The type of the latter is not extant, and inasmuch as the distribution of the two species seems to be nearly the same, the indefinite type locality of *marginicollis* gives no aid in the interpretation. Thus the writer has arbitrarily assigned the more common of the two to *marginicollis*; it can be distinguished by its larger size (4.1–4.8 mm.) and the structure of the median lobe and armature (pl. 9, fig. 1, *a c*) of the aedeagus, the sinuate forks of the median armature being particularly characteristic; in *confusus* the forks are straight. *Margarinotus felipae* Lewis, known from Kansas and Iowa, is a larger and more elongate-oblong species than either of the above mentioned; in the structure of the median lobe and armature (pl. 9, fig. 2) it closely approaches *marginicollis*, but has straight armature forks.

***Margarinotus lecontei* sp. nov. (pl. 8, fig. 3)**

*Hister cognatus* auct. (not Le Conte, Bost. Journ. Nat. Hist., p. 58, 1845).

*Type* from Delavan, Wisconsin. A male in the collection of Field Museum of Natural History. Collected July 13, 1940, by Henry S. Dybas.

*Paratypes.*—Wisconsin: Eight specimens, same locality as the type, collected June 18–July 13 (H. S. Dybas). Seven from Madison, on decaying bracket fungus, collected August 11, 1935 (H. R. Dodge). Two from Clintonville, on decaying mushrooms, collected October 23, 1935 (H. R. Dodge).—Minnesota: Five from Ramsey County, on rotting banana, collected June 26, 1936 (H. R. Dodge). One from St. Paul, on rotten banana, collected August 19, 1935

(H. R. Dodge). One from Washington County, collected September 7, 1936 (H. R. Dodge).—Michigan: One from Camp Steuben, Schoolcraft County, collected May 31, 1935 (J. R. Gross). Illinois: Two from River Forest, in bracket fungus, collected September 28, 1941 (J. L. Hill). Three from Urbana, collected April 29, 1920. One from Algonquin (W. A. Nason).—Indiana: Five from Beverly Shores, collected May, 1933 (H. S. Dybas).—Maine: One from Monmouth (C. A. Frost).—Massachusetts: One from Framingham, collected April 19, 1910 (C. A. Frost). Two from Amherst, collected May 2, 1930 (Field). One from Natick, collected May 22, 1938 (C. A. Frost).—New York: Five from South Fallsberg, collected May 7–September 22, 1941 (W. Spector). One from Cooks Falls, collected April 23, 1929. One from Olcott, collected July 18, 1926 (H. Dietrich).—Pennsylvania: One from Bear Lake. One from Jeannette, collected May 24 (H. G. Klages). One from Alleghen.—Maryland: One from Edgewood, collected October 18, 1918 (H. Dietrich).—North Carolina: Two labeled “N.C.” One from Sunburst, collected October 25, 1935 (O. L. Cartwright).—South Carolina: One from Mountain Rest, collected August 11, 1931 (O. L. Cartwright). One from Rocky Bottom, collected May 3, 1931 (O. L. Cartwright).—Georgia: One from Clayton, collected July, 1910 (W. T. Davis).—Tennessee: One from Gatlinburg, Great Smoky Mountains National Park, on fungus, collected June 16, 1942 (C. H. Seevers).—Canada: One from Montreal, Quebec. Six from Hemmingford, Quebec, June 7–21, 1917 (J. I. Beaulne). One from Fort Coulonge, collected June 13, 1918 (J. I. Beaulne). Five from Ottawa, Ontario, collected September 23, 1912 (J. I. Beaulne). Four labeled “Ontario.”

Paratypes are in the collections of Field Museum, the University of Illinois, Edward S. Ross, H. R. Dodge, William Spector and Rupert L. Wenzel. At a later date others will be deposited in the larger collections of the country.

*Description.*—Form rather broadly oblong-oval. Head minutely, sparsely punctate. Frontal stria deeply impressed, straight at middle or feebly, outwardly arcuate.

Marginal pronotal stria very fine along the sides, obsolescent basally, absent on basal half or third, well impressed along anterior margin but narrowly interrupted at middle for about half the width of the head. Outer lateral pronotal stria absent, the inner complete and well impressed, crenate, usually sinuate along the sides; interval between the lateral stria and the margin distinctly convex.

Disk sparsely punctulate at middle; deep and rather close punctures present in a longitudinal area on each side within the lateral stria, the punctures coarser basally.

Marginal epipleural stria absent, marginal elytral stria complete, very coarse apically, rather closely and shallowly punctate basally. Epipleural fossette smooth or very sparsely punctate. External sub-humeral and dorsal striae one to four complete, well impressed; fifth dorsal and sutural striae a little finer than the preceding, both variable in length, the fifth usually present on apical two-fifths or half, sutural a little longer, frequently extending a little beyond the middle. All the dorsal striae distinctly crenate.

Propygidium and pygidium coarsely, densely punctate (punctures sometimes feebly umbilicate) with a few microscopic punctures intermingled; pygidial punctures minute at apex.

Prosternal keel sparsely punctulate, usually with rudimentary striae between the coxae; lobe rather strongly deflexed, sparsely and moderately punctate, the marginal stria often narrowly interrupted at middle and somewhat abbreviated laterally.

Anterior margin of mesosternum feebly emarginate, marginal stria entire, crenate. Meso-metasternal stria obtusely angulate at middle, united on each side with the oblique, coarsely punctate, lateral metasternal stria which extends posteriorly nearly to, but not united with, the oblique stria which extends inwardly from the middle of the metasternal-metepisternal suture.

Protibiae six-denticulate.

Length 3.67–4.9; width 2.7–3.52 mm.

*Remarks.*—This rather common species has been referred to as *cognatus* by all workers since the elder Le Conte; however, reference to the original description and figure of that species clearly indicates that the name *cognatus* applies to the species described by Casey as *unicus* and since referred to by that name. Perhaps the error has resulted chiefly from reference to Le Conte's figure, poor impressions of which do not show the characteristic basal arc of the fourth dorsal stria. I previously considered (1936) that the two were one species since the only apparent differences were in the extent of pronotal punctation and in the presence of the basal arc; however, the median lobe and armature of the aedeagus are entirely different.

**Margarinotus cadaverinus** Hoffmann (= *Hister obtusatus* auct., *H. virginiae* Casey).

*Hister cadaverinus* Hoffmann, Ent. Hefte, 1, p. 34, pl. 1, fig. 2, 1808.

(?) *Hister obtusatus* Harris, Trans. Hartl. Nat. Hist. Soc., 1, p. 76, 1837.

*Hister obtusatus* auct.

*Hister virginiae* Casey, Ann. N. Y. Acad. Sci., 7, p. 541, 1898.

The species which has been identified by North American workers as *Hister obtusatus* Harris is the palaearctic *cadaverinus*, probably introduced into this country and now very common throughout the eastern and middle-western states. Since the type of *obtusatus* apparently is no longer in existence, it is not possible to determine finally whether or not *obtusatus* auct. equals *obtusatus* Harris. The genital structures of the male type of *virginiae* have been dissected and examined by the writer.

**Margarinotus stercorarius** Hoffmann (= *Hister semisculptus* Le Conte)

*Hister stercorarius* Hoffmann, Ent. Hefte, 1, p. 57, pl. 1, fig. 5, 1803.

*Hister semisculptus* Le Conte, Smiths. Misc. Coll., 6, p. 60, 1863.

The writer has studied the type of *semisculptus* and found it to be identical with the palaearctic *stercorarius*. In North America the species has been taken in "Illinois" (type locality of *semisculptus*), at Framingham, Massachusetts (C. A. Frost), and at Forest Grove, Cornelius, and Blooming, Oregon (Schuh and Gray). Through the courtesy of Dr. E. S. Ross, the writer has seen a fairly extensive series from the Oregon localities.

Further synonymy of *cadaverinus* and *stercorarius* may be found in the Genera insectorum (Bickhardt, 1917).

**Genus Atholus** Thomson

**Atholus bolteri** sp. nov.

*Type* from "Fla." Sex undetermined. No. 25572 in the Le Conte collection, Museum of Comparative Zoology. Collected by Bolter.

*Description*.—Form elongate-oval, rather strongly convex. Color black, shining. Head strongly, very finely, rather sparsely punctate. Frontal stria straight at middle, feebly crenate, complete. Supraorbital stria absent. Labrum somewhat compressed antero-posteriorly.

Pronotum nearly twice as broad as long (12:7). Sides straight and rather strongly convergent nearly to apex, thence abruptly angulate to the apical angles. Surface sparsely punctulate throughout. Marginal pronotal stria complete laterally, extending around apical angles and interrupted along anterior margin for less than the



width of the head. Outer lateral pronotal stria rather close to the margin, finely subcariniform, extending from the region of the apical angle to basal fifth; inner lateral pronotal stria complete, strongly sinuous and finely crenate laterally, very distinct and subcariniform around the anterior angle and along the anterior margin; within the anterior angle of the inner lateral stria is a small, alutaceous, subopaque area which has coarser, rather closely placed punctures.

Elytra together distinctly broader at humeri than pronotum, sides rather evenly, distinctly arcuate from base to apex. Epipleura alutaceous; marginal epipleural stria very fine and close to the margin, nearly indistinguishable. Marginal elytral stria complete, well impressed; lateral and approximate to it on apical half is a short stria. Oblique humeral very finely impressed. Subhumeral striae absent. Dorsal striae feebly crenate, first to fifth and sutural complete, the fifth and sutural united in an arch. Elytra sparsely punctulate.

Pygidia alutaceous. Propygidium rather coarsely, rather evenly, moderately sparsely punctate, the punctures separated by their diameters for the most part, a few minute punctures intermingled. Pygidium basally rather evenly, a little more finely punctate than the propygidium, the punctures moderately sparse, becoming abruptly finer on apical half, minute at apex.

Ventral surface alutaceous throughout. Prosternum punctulate, without striae; prosternal lobe with a deep, inverted U-shaped marginal stria, sparsely, deeply, finely punctate. Anterior margin of mesosternum feebly, outwardly arcuate, the marginal stria subcariniform, well impressed, complete, narrowly separated from a short arcuate stria which extends around the posterior margin of the middle coxal cavity. Between the marginal stria and the antero-lateral angles on each side is a short stria. Meso-metasternal stria subcariniform, finely crenate, united on each side with the lateral metasternal stria which extends obliquely posteriorly to a point not far removed from the metacoxa. Sternal disks with a few microscopic punctures which are most evident on the mesosternum. First abdominal sternum with a single oblique stria on each side medial to the hind coxa, the stria subcariniform, extending from base to apex, its apical half rather coarsely crenate.

Anterior tibiae tridentate, the basal tooth small, the apical tooth strongly produced and "bifid" (bearing two blunt denticles). Middle and posterior tibiae biserially spinulose; spinules of marginal row fairly stout and moderately long, those of the submarginal row short, stubby; a row of setae is present in addition to the spinules.

*Measurements.*—Length 4.85; width 3.25 mm.

*Remarks.*—The pronotal striae of *bolteri* recall those of *Atholus tornatus* Le Conte,<sup>1</sup> but these two species are otherwise easily separated by their form and the entirely different character of their elytral striae; *bolteri* may be separated from all the other North American species of *Atholus* by its larger size, the presence of an alutaceous, punctate area on each side within the anterior angle of the inner pronotal stria, and its alutaceous ventral surface.

### Genus *Phelisteroides* Wenzel and Dybas

The genus *Phelisteroides* was erected by Wenzel and Dybas in 1941 to include two previously known histerids and three which were described as new. Descriptions of four additional species are given below.

#### *Phelisteroides punctipennis* sp. nov.

*Type* from Chapada, Brazil. A specimen of undetermined sex in the collection of Carnegie Museum. Collected in November.

*Description.*—Form oblong, not very strongly convex, broadly and feebly depressed along the suture. Pronotum and elytra sparsely, minutely punctulate. Color deep reddish-brown, nearly black. Head strongly, not densely punctulate. Epistoma distinctly impressed basally; vertex shallowly impressed, almost flat. Frontal stria complete at middle, narrowly interrupted on each side, not united with the supraorbital.

Anterior pronotal margin feebly, outwardly arcuate at middle behind the head. Marginal stria complete laterally, interrupted at middle of anterior margin for a little less than the width of the head. Lateral stria well impressed, very feebly crenate laterally, more distinctly so anteriorly, narrowly interrupted on each side behind the eyes, the median detached portion with recurved ends. Numerous coarse punctures present on each side medial to the lateral stria.

Epipleura bistriate, both striae strongly punctate, the outer (marginal epipleural) present on a little more than apical half, the inner (marginal elytral) very wide and rather shallow, especially near base. External subhumeral stria punctate, deeply impressed on apical half, with a disconnected basal appendix which extends

<sup>1</sup> Since redescribing this aberrant species (1939, p. 389), I have examined the genitalia of a male example and established its identity as a member of the genus *Atholus*.

halfway to base; internal subhumeral complete, strongly impressed. Dorsal striae crenate, first to fourth complete, the fifth extending to middle; sutural abbreviated at basal fourth. Elytral apices with sparse moderate punctures intermingled with the punctulation.

Propygidium coarsely, densely, umbilicately punctate, the narrow intervals with scattered minute punctures. Pygidium very densely, rather deeply, minutely punctate, with numerous coarser (though rather fine) punctures intermingled, these separated by one to two times their diameters; appearance subopaque. Pygidial sulcus very fine and shallow, scarcely distinguishable, its bottom with closely placed fine punctures.

Prosternum with a very fine, transverse, strigose microsculpture, this less distinct on the lobe, which is deeply, finely punctate; lobe with a deep, apical marginal stria which is strongly abbreviated on each side. Carinal striae not very strongly convergent, nearly straight, feebly sinuate near base, united anteriorly in a rounded arch and across base by a fine transverse stria. Anterior margin of mesosternum broadly, distinctly emarginate. Disk of mesosternum with the same type of ground sculpture as the prosternum; marginal mesosternal stria subcariniform, finely crenate, rather narrowly interrupted at middle. Meso-metasternal stria cariniform, crenate, rather strongly and evenly arcuate, encroaching upon the mesosternal disk, its median portion reaching the anterior margin, united on each side (about one-sixth from lateral margin) with the lateral metasternal stria. Metasternal disk rather closely, deeply punctulate anteriorly, the punctures becoming a little larger and sparser posteriorly and abruptly coarse along the hind margin near the hind coxae. First abdominal sternum bistrate on each side medial to the hind coxa, the inner stria coarse and oblique, reaching the hind margin; the outer stria extends a little beyond the middle. Intercoxal disk coarsely punctate, punctulation intermingled, the coarse punctures disappearing on apical two-fifths, a narrow apical margin transversely micro-strigose.

Protibiae not very strongly expanded, seven-denticulate, the apical tooth and the two basal ones fine. Meso- and metatibiae with about five rather short spinules on outer edge, the basal spinules fine.

Length 2.57; width 1.95 mm.

*Remarks.*—The extensively punctate metasternal disk and the complete inner subhumeral stria are distinctive characters of this species. The pygidial sulcus is so fine that it is easily overlooked.

***Phelisteroides ruptistrius* sp. nov.**

*Type* from Santarem, Brazil. A specimen of undetermined sex in the collection of Carnegie Museum. Collected in December.

*Paratype*. A specimen of undetermined sex, same data as the type, in the collection of Field Museum.

*Description*. Form rather broadly oblong-oval, moderately convex, a little depressed along the suture. Color deep reddish-brown, shining. Head, pronotum, pygidium and under side densely punctulate. Epistoma and vertex feebly convex; frontal stria absent, supraorbital present.

Pronotal sides convergent, very feebly arcuate on basal half, thence more strongly arcuate and convergent to apical angles; anterior margin very feebly, outwardly arcuate at middle. Marginal stria complete laterally and behind the head. Lateral stria complete laterally, rather close to the margin, deeply impressed, finely crenated, narrowly interrupted on each side behind the eyes, the median detached portion more strongly crenate and with recurved ends. Punctulation more feeble than that of head, noticeably so in a rather broad, feebly depressed, antescutellar area; sparse, larger punctures intermingled in a broad longitudinal area on each side medial to the lateral stria and in a narrow band behind the anterior margin, the innermost punctures being the strongest.

Elytra microscopically, sparsely punctulate, apices with a submarginal row of moderately fine punctures. Epipleura bistrate, the outer or marginal epipleural stria rather smoothly impressed, the inner or marginal elytral stria coarse and strongly, crenately punctate. External subhumeral stria present on apical half, strongly impressed, crenately punctate; internal subhumeral absent; oblique humeral finely impressed. Dorsal striae one to three complete, well impressed, but not coarsely so, rather finely and crenately punctate; fourth dorsal broadly interrupted on apical sixth or seventh and on basal third or a little less, its base arched inwardly; fifth dorsal subequal to the apical rudiment of the fourth. Sutural abbreviated at about basal third, wider and more strongly crenate than any of the preceding striae.

Propygidium feebly punctulate, very sparsely so basally; coarse punctures umbilicate, separated by less than their diameters basally, becoming sparser and finer apically. Pygidium densely punctulate, but not deeply so, somewhat larger punctures sparsely intermingled; marginal sulcus fine, striiform, finely crenate.

Prosternal punctulation deep, effect subrugose, with somewhat coarser sparse punctures intermingled; lobe rather broad at apex with a coarse marginal stria; keel broad at base; carinal striae straight and convergent (not strongly so), extending nearly to lobe and united anteriorly in a relatively broad arch, transversely united across base. Anterior mesosternal margin broadly, feebly emarginate; marginal stria entire, finely crenate. Meso-metasternal stria arcuate and crenate, not reaching the middle of the mesosternal disk, united with the lateral metasternal stria at about lateral fourth on each side, the two striae combined forming an almost regular arc of 180 degrees; meso-metasternal suture crenately punctured on each lateral fourth. Suture between the metasternum and the first abdominal sternum coarsely impressed and subsulciform between the coxae. First abdominal sternum bistriate on each side medial to the coxa, the inner stria fine, crenate, and arcuate, extending from basal to apical margin; the outer stria extends to middle. Punctulation obsolete near apex of intercoxal disk.

Protibiae rather narrow (abruptly so on basal third), with about seven spiniform denticles, the two apical and the basal denticles very small. Mesotibiae with five spinules on outer margin. Metatibiae with four spinules on apical half of outer margin.

Length 2.2–2.3; width 1.76–1.85 mm.

*Remarks.*—This species may be distinguished by its densely punctulate head, pronotum and under surface, its broad prosternal keel, the absence of a frontal stria and the broadly interrupted fourth dorsal stria. Only one other known species, *punctipennis*, has a fine, striiform pygidial sulcus.

### ***Phelisteroides angustisternus* sp. nov.**

*Type* from Para, Brazil. A male in the collection of Field Museum of Natural History. Collected in June.

*Description.*—Form rather broadly oblong, moderately convex, a little depressed along the suture. Color reddish-brown, shining. Head, pronotum, elytra, and sternal disks sparsely punctulate. Frontal stria straight at middle, well impressed, united on each side with the complete supraorbital. Epistoma and vertex lightly impressed.

Pronotal sides straight and a little convergent on somewhat more than basal half, thence abruptly oblique, straight and convergent to apical angles; lateral margins deflexed on a little less than basal half; apical margin feebly, outwardly arcuate behind the head.

Marginal stria complete laterally and behind the head. Lateral stria crenate, rather distant from the sides, narrowly interrupted on each side behind the eyes, the detached median portion with feebly recurved ends. A few moderate punctures present on each side medial to the lateral stria.

Epipleura with two strongly bent striae, the outer fine, the inner strong and crenately punctate, its outer edge strongly subcariniform. External subhumeral well impressed, extending from middle nearly to apex; internal subhumeral absent; oblique humeral very finely impressed. Dorsal striae one to three complete, crenately punctate, more strongly so apically; fourth dorsal slightly longer than the third, the latter reaching the middle. Sutural stria abbreviated at basal fourth, strongly crenate, much wider basally.

Propygidium with coarse, close, umbilicate punctures in a basal, marginal row and in a broad, median, abruptly limited, trapezoidal area, elsewhere minutely, very densely punctate. Pygidium very densely, minutely punctate, with a few somewhat coarser punctures intermingled; basal margin with a row of coarser, though rather fine, punctures; marginal sulcus strong and deep, its edge crenate.

Prosternal lobe with a strong marginal stria; carinal striae nearly straight, strongly divergent posteriorly and united across basal margin by a very fine, feeble line, the striae rather close anteriorly and united in a narrow, rounded arch about one-third from lobe; keel moderately broad basally, strongly narrowed apically, the portion anterior to the striae being narrow, obtusely cariniform. Anterior mesosternal margin broadly, feebly emarginate; marginal stria complete. Meso-metasternal stria rather feebly crenate, arcuate on middle three-fourths of its width and arching halfway up the mesosternal disk, continuous on each side with the lateral metasternal stria. First abdominal sternum with three striae on each side medial to the hind coxa; the inner stria is feebly oblique, crenate, extending nearly to the apical margin, and continued inwardly along basal margin for about a third of the width; the middle stria is parallel to the inner and extends nearly to apex; the third is close to the second and reaches a little beyond the middle.

Protibiae rather narrow, with three, low, blunt, denticle-bearing teeth in addition to a very fine apical tooth situated near the insertion of the tarsus, the basal tooth situated a little behind the middle of the outer edge. Mesotibiae with five, metatibiae with four spinules on outer edge.

Length 2.22; width 1.5 mm.

*Remarks.*—This species is characterized by the narrow prosternal keel with relatively short carinal striae, the small number of protibial teeth, the presence of three striae on each side of the first abdominal sternum, the continuation of the inner of these striae along the basal margin of that segment, and the limitation of the coarse propygidial punctures to a basal row and a broad, median trapezoidal area.

***Phelisteroides fossipygus* sp. nov.**

*Type* from Santarem, Brazil. A specimen of undetermined sex in the collection of Carnegie Museum.

*Description.*—Form broadly oblong-oval, moderately convex, a little depressed along the suture. Head, pronotum, elytra and under side minutely, sparsely punctulate. Epistoma and vertex distinctly impressed; frontal stria complete, well impressed, united on each side with the complete supraorbital.

Anterior margin of pronotum distinctly, outwardly angulate at middle behind the head. Marginal pronotal stria complete laterally, interrupted along apical margin for the width of the head. Lateral stria crenated, complete, rather distant from the side margins, continued along the anterior margin, straight behind the head, not following the angular conformation of the margin. A few moderate punctures present on each side within the lateral stria.

Epipleura bistriate. External subhumeral complete, bent near middle, curved inwardly at apex, the basal portion very fine, the apical strong and with a crenate, subcariniform outer margin; internal subhumeral extending from basal sixth to a little in front of middle. Dorsal striae one to three complete, crenate, well impressed, the third deeply so at base; fourth and fifth dorsals subequal, present on a little more than apical half, distinctly more crenate than the preceding. Sutural stria abbreviated at basal fourth, strongly crenate, very broad basally.

Propygidium coarsely, densely punctate in a median triangular area and in a basal row, elsewhere minutely and very densely punctate. Pygidium minutely, very densely punctate, with a few almost indistinguishably coarser punctures intermingled; pygidial sulcus strong, deep, terminating basally on each side in an expanded, deep, tear-shaped fovea.

Prosternal lobe with a coarse marginal stria; carinal striae nearly straight, strongly divergent posteriorly, not united across basal margin, extending nearly to the lobe and united anteriorly in a narrow, rounded arch. Anterior margin of mesosternum feebly

emarginate for its entire width; marginal mesosternal stria complete, well impressed, continuous posteriorly on each side with the post-coxal stria. Meso-metasternal stria moderately crenate, feebly angulate at middle, scarcely entering upon the mesosternal disk, continuous on each side with the lateral metasternal stria, which is straight and extends obliquely posteriorly to a point near the middle of the hind coxa. First abdominal sternum with two striae on each side medial to the hind coxa; the inner of these is strong, feebly arcuate, and extends from basal margin to apical fourth; the outer extends nearly to middle.

Protibiae not much expanded, with six to seven teeth, the apical tooth and the two basal ones very small, spinule-like. Meso- and metatibiae with about four spinules on their outer margins.

Length 2.4; width 1.9 mm.

*Remarks.*—This species is allied to *fungicolus* but may be separated from it by a number of characters, which are given in the key.

#### KEY TO THE KNOWN SPECIES OF PHELISTEROIDES

1. Dorsal striae 1-4 complete. . . . . 2  
 Dorsal striae 1-3 complete; fourth dorsal either extending a little beyond the middle or broadly interrupted at middle and represented on basal third and by an apical rudiment. . . . . 5
2. Internal subhumeral stria complete, coarsely impressed. . *punctipennis* sp. nov.  
 Internal subhumeral stria absent or represented by an apical rudiment only. . 3
3. Marginal mesosternal stria present at sides only; frontal stria of head complete and united on each side with the supraorbital.  
*propygidialis* Hinton (1935, p. 12)  
 Marginal mesosternal stria not interrupted at middle, complete; frontal stria narrowly interrupted on each side, not united with the supraorbital. . . . 4
4. Lateral pronotal stria narrowly interrupted on each side behind the eyes, so that the median portion is detached; pygidial sulcus rather wide and deep, narrowest at apex; coarser pygidial punctures a little denser basally, elsewhere very sparse. . . . *panamensis* Wenzel and Dybas (1941, p. 450)  
 Lateral pronotal stria complete; pygidial sulcus regular and narrow; coarser pygidial punctures rather dense, separated by 1-2 times their diameters.  
*miladae* Wenzel and Dybas (1941, p. 448)
5. Frontal stria of head absent; fourth dorsal stria broadly interrupted, represented on about apical sixth and on a little more than basal third, arched toward the scutellum at base. . . . . *ruptistrius* sp. nov.  
 Head with a frontal stria; fourth dorsal stria present on apical half or slightly more. . . . . 6
6. External subhumeral stria complete; internal subhumeral represented on apical half or a little more; coarse propygidial punctures scattered throughout or limited to a median triangular area. . . . . 7  
 External subhumeral present on apical half; internal subhumeral absent; coarse propygidial punctures abruptly limited to a basal row and a broad, median, trapeziform area. . . . . *angustisternus* sp. nov.



7. Pygidial sulcus terminating basally on each side in a large, deep, expanded, tear-shaped fovea; marginal pronotal stria absent behind the head 8  
Pygidial sulcus not thus excavated and expanded, though it is wider basally; marginal pronotal stria complete *pygidialis* Lewis (1908, p. 157)
8. Coarse propygidial punctures limited to a well-defined, median triangular area and a row along basal margin; meso-metasternal stria feebly angulate at middle, scarcely entering upon the mesosternal disk; anterior pronotal margin angulately projecting at middle *fossipygus* sp. nov.  
Coarse propygidial punctures scattered throughout; meso-metasternal stria strongly, broadly arcuate, its median portion approaching the anterior mesosternal margin and the marginal mesosternal stria; anterior pronotal margin straight at middle *fungiculus* Wenzel and Dybas (1941, p. 452)

### Subfamily Hetaerinae

#### Tribe Hetaeriomorphini

##### *Yarmister emersoni* sp. nov.

*Type* from Chapada, Brazil. A specimen of undetermined sex in the collection of Carnegie Museum. Collected in August.

*Description*.—Form parallel-sided, cylindrical. Color black, shining. Eyes rather large. Surface minutely, sparsely punctulate, with the exception of the pygidia, which are finely punctate. Epistoma short, with two striae, of which the first is marginal; the second (a little posterior to the first) is arcuate at middle and extends posteriorly along the inner margins of the eyes to unite with the fine, complete supraorbital.

Marginal pronotal stria present only around the anterior angles, absent behind the head and along the sides. Lateral stria well impressed, rather close to the margin, complete behind the head and extending for a short distance along basal margin.

Epipleura with two fine, subcariniform, complete, closely placed striae, the marginal epipleural and marginal elytral, the latter continued across apical margin and united with the sutural stria. External subhumeral complete, its outer edge subcariniform; internal subhumeral finely impressed, rather distant from the external, except apically, and parallel to the first dorsal (the interval between them equal to that between the first and second dorsals); oblique humeral finely impressed. First and second dorsal striae complete (the second obsolete on basal sixth on one side in the type); third dorsal obsolete on basal third or fourth; fourth and fifth dorsals absent. Suture stria complete, arching outward at base. In the interval between the third dorsal and the sutural is a coarse, longitudinal, striiform impression, possibly representing the fourth dorsal.

All the dorsal striae are finely impressed, and are apically hooked and united with the marginal elytral stria.

Fifth abdominal tergum with a triangular area exposed between the elytral apices, the area margined by a single chevron-shaped stria. Propygidium with a fine, continuous marginal stria along basal, lateral, and apical margins.

Prosternum nearly as in *barberi*, but with the carinal striae more narrowly separated between the coxae and united along basal margin, and with the intermediate striae more strongly divergent apically. Marginal mesosternal stria narrowly interrupted at middle behind the deep emargination. Meso-metasternal stria single, obsolete on each side. A single, well-impressed lateral metasternal stria is present on each side and extends posteriorly from the outer end of the meso-metasternal suture to the hind coxa. Elevated metasternal sides with transverse, parallel striae which extend from a point near the lateral metasternal stria laterally to the metasternal-metepisternal suture.

Tibiae nearly as in *barberi*, differing in minor details of sculpture; inner margin of mesotibiae less arcuate than in that species.

Length 3.3; width 1.71 mm.

*Remarks.*—The genus *Yarmister* was erected by the writer in 1938 for a single new species *barberi*, from Florida; *emersoni* may be the undescribed species referred to at that time.

The two species may be separated as follows:

1. Elytra with a coarse, striiform impression on basal third near the sutural stria; marginal elytral stria present along apical margin, all the other striae hooked apically and united with it at their respective intervals. Marginal mesosternal stria narrowly interrupted behind the median emargination; mesosternum without discal striae; meso-metasternal stria obsolete on each side; a single lateral metasternal stria present on each side; elevated metasternal sides with transverse, concentrically arranged striae which extend laterally from a point near the lateral stria to the metasternal-metepisternal suture, the anterior striae strongly arcuate . . . *emersoni* sp. nov.
2. Elytra without a basal impression near the sutural stria; marginal elytral stria not present along apical margin, the dorsal striae hooked inwardly at apex. Marginal mesosternal and meso-metasternal striae complete; mesosternum with two posteriorly divergent, oblique striae which divide the disk into three parts; two lateral metasternal striae present on each side, both coarse and sulciform, the outer one deeply, coarsely punctate; elevated metasternal sides with more or less irregular, parallel striae of varying length. . . . *barberi* Wenzel (1939, p. 392)

The following is a list of the new genera and species described in the preceding pages.

## Subfamily Abraeinae

- |  |                                       |
|--|---------------------------------------|
| <i>Acritomorphus praecursor</i> gen. et sp. nov. | <i>Aeletes nevermanni</i> sp. nov.    |
| <i>Halacritus alutiger</i> sp. nov.              | <i>Aeletes rectistrius</i> sp. nov.   |
| <i>Halacritus blackwelderi</i> sp. nov.          | <i>Aeletes rugiceps</i> sp. nov.      |
| <i>Halacritus glabrus</i> sp. nov.               | <i>Aeletes rugipygus</i> sp. nov.     |
| <i>Halacritus lewisi</i> sp. nov.                | <i>Aeletes schwarzi</i> sp. nov.      |
| <i>Aeletes aciculatus</i> sp. nov.               | <i>Aeletes subniger</i> sp. nov.      |
| <i>Aeletes assimilis</i> sp. nov.                | <i>Aeletes sulcipennis</i> sp. nov.   |
| <i>Aeletes dybasi</i> sp. nov.                   | <i>Aeletes termitophilus</i> sp. nov. |
| <i>Aeletes laevis</i> sp. nov.                   | <i>Aeletes troglodytes</i> sp. nov.   |
| <i>Aeletes lissosternus</i> sp. nov.             |                                       |

## Subfamily Trypanaeinae

- Trypanaeus fucatus* sp. nov.

## Subfamily Saprinae

- Reichardtia* gen. nov.  
*Saprinus oblongus* sp. nov.  
*Saprinus carinipennis* sp. nov.

## Subfamily Dendrophilinae

- |                                       |   |
|---------------------------------------|---|
| <i>Bacanius crenulatus</i> sp. nov.   | <i>Carcinops densepunctata</i> sp. nov. |
| <i>Bacanius pusillus</i> sp. nov.     | <i>Carcinops exigua</i> sp. nov.        |
| <i>Bacanius rugisternus</i> sp. nov.  | <i>Carcinops plaumanni</i> sp. nov.     |
| <i>Bacanius striatinotum</i> sp. nov. | <i>Carcinops schwarzi</i> sp. nov.      |
| <i>Bacanius sulcisternus</i> sp. nov. | <i>Carcinops tuberosa</i> sp. nov.      |
| <i>Carcinops assimilis</i> sp. nov.   | <i>Geocolus caecus</i> gen. et sp. nov. |
| <i>Carcinops cribripuga</i> sp. nov.  |   |

## Subfamily Tribalinae

- Epierus cylindricus* sp. nov.  
*Epierus darlingtoni* sp. nov.  
*Epierus striatipygus* sp. nov.

## Subfamily Histerinae

- |   |   |
|---|---|
| <i>Phylloma multispinosum</i> sp. nov.            | <i>Margarinotus tristriatus</i> sp. nov.      |
| <i>Hololepta (Hololepta) striaticeps</i> sp. nov. | <i>Margarinotus weymarni</i> sp. nov.         |
| <i>Hololepta (Leionota) insularis</i> sp. nov.    | <i>Atholus bolteri</i> sp. nov.               |
| <i>Margarinotus balloui</i> sp. nov.              | <i>Phelisteroides angustisternus</i> sp. nov. |
| <i>Margarinotus confusus</i> sp. nov.             | <i>Phelisteroides fossipygus</i> sp. nov.     |
| <i>Margarinotus hailer</i> sp. nov.               | <i>Phelisteroides punctipennis</i> sp. nov.   |
| <i>Margarinotus lecontei</i> sp. nov.             | <i>Phelisteroides ruptistrius</i> sp. nov.    |
| <i>Margarinotus striolides</i> sp. nov.           | <i>Yarmister emersoni</i> sp. nov.            |

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## PLATES



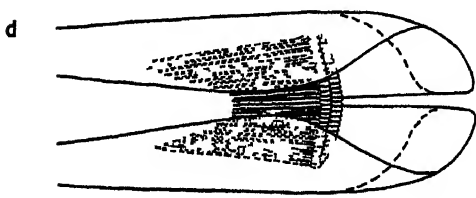
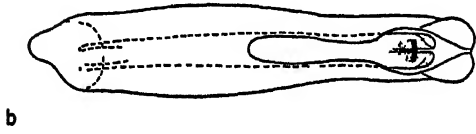
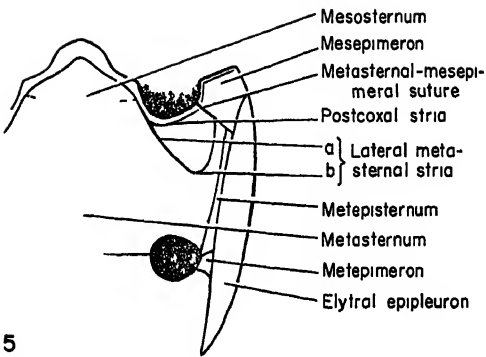
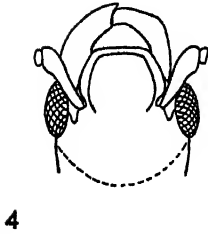
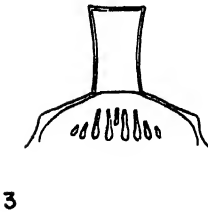
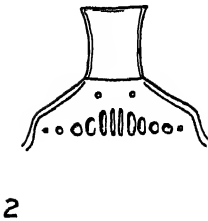
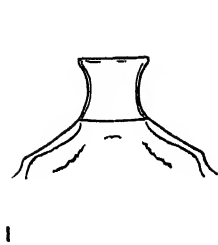
## PLATE 1

FIGS. 1-3. *Aeletes dybasi* sp. nov., *A. troglodytes* sp. nov., and *A. politus* Le Conte, respectively. Prosternal keel and mesosternal disk.

FIG. 4. *Aeletes* sp. Dorsal view of head (semidiagrammatic) showing complete marginal epistomal stria.

FIG. 5. *Halacritus* sp. Partial semidiagrammatic representation of meso- and metasternum showing complete lateral metasternal stria as it exists in *H. maritimus* Le Conte and *H. parallelus* Casey; *a*, its point of termination in *H. glabrus* sp. nov., *b*, the approximate point of termination in other species.

FIG. 6. *Acritomorphus praecursor* gen. et sp. nov. Aedeagus. *a*, Dorsal, *b*, ventral, *c*, lateral views. *d*, Tip of median lobe, much enlarged, dorsal view.

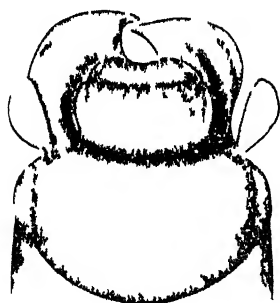


## PLATE 2

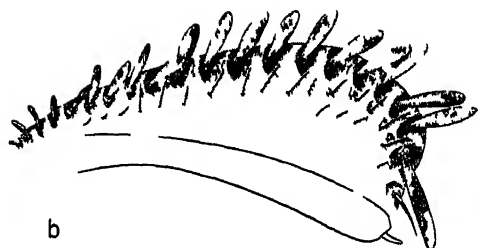
FIG 1 *Reichardtia pedator* Sharp a, Dorsal view of head b, Inner face of protibia (sculpture partially indicated)

FIG 2 *Geomysaprinus rugosifrons* Fall a, Ventral view of metasternum and abdomen (non-setigerous punctures omitted) b, Inner face of protibia

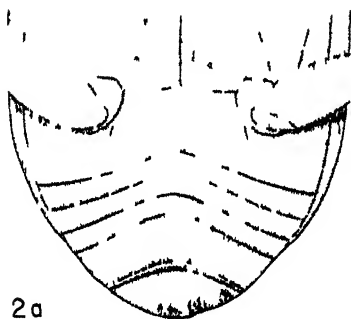
FIG. 3 a, c, *Phylloma multispinosum* sp nov Inner faces of pro- and mesotibiae b, d, *P corticale* Fabricius, same structures



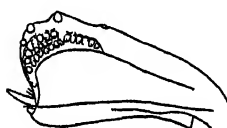
1a



b



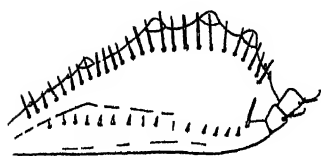
2a



3a



b



b



c



d

PLATE 3

*Geocolus caecus* gen. et sp. nov.

- FIG. 1. Dorsal aspect of beetle, appendages omitted.
- FIG. 2. Prothorax, ventral view, coxae removed.
- FIG. 3. Head, dorsal view.
- FIG. 4. Head and anterior region of prothorax, lateral view.
- FIG. 5. Aedeagus. *a*, Dorsal, *b*, lateral views.
- FIG. 6. *a, b, c*, Inner face of protibia, outer faces of meso- and metatibiae.

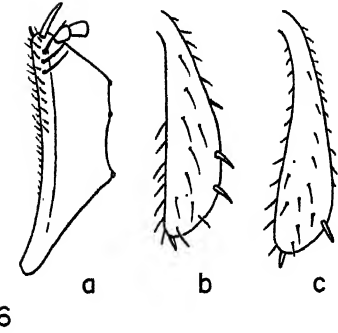
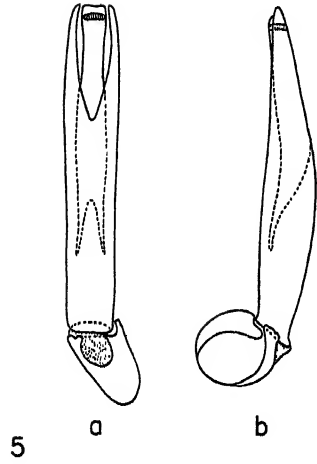
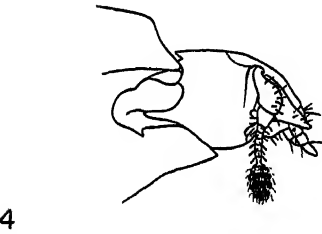
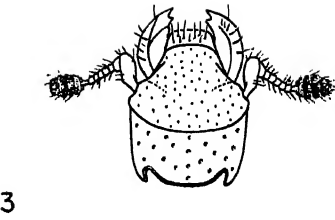
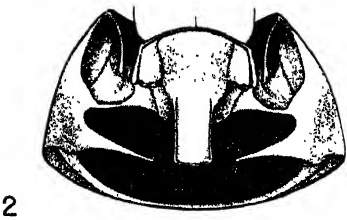
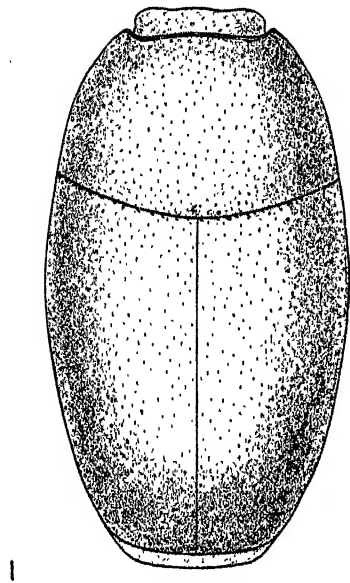


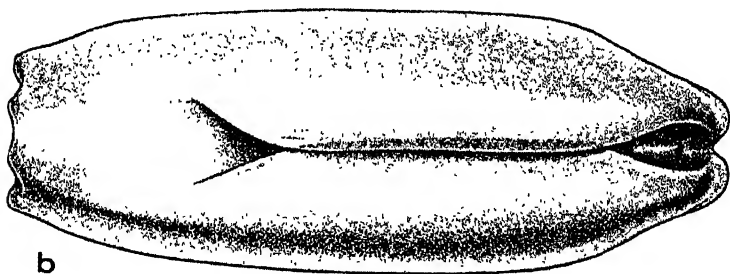
PLATE 4

FIG. 1. *Margarinotus tristriatus* sp. nov. Aedeagus. *a*, Lateral, *b*, dorsal views (basal piece omitted in *b*).

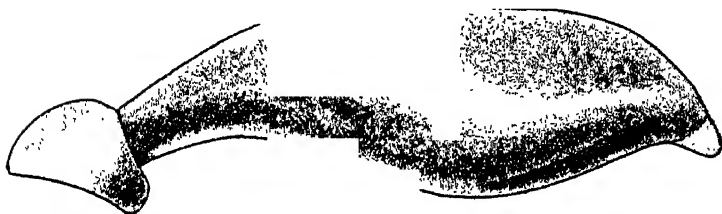
FIG. 2. *Margarinotus weymarni* sp. nov. Structures as in fig. 1.



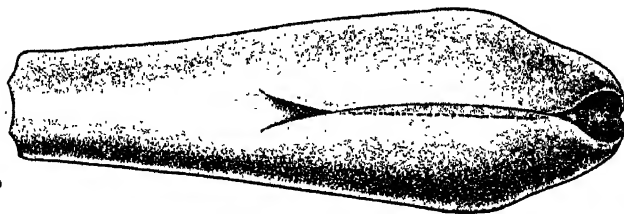
1a



b



2a



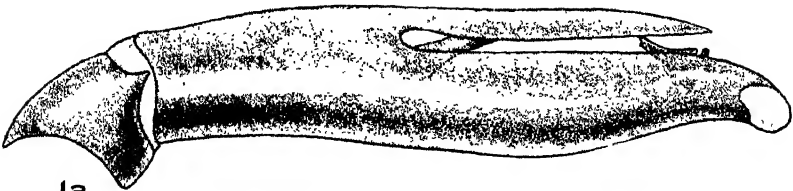
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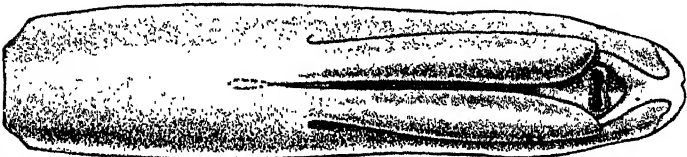
PLATE 5

FIG. 1. *Margarinotus koenigi* Schmidt. Aedeagus. *a*, Lateral, *b*, dorsal views (basal piece omitted in *b*).

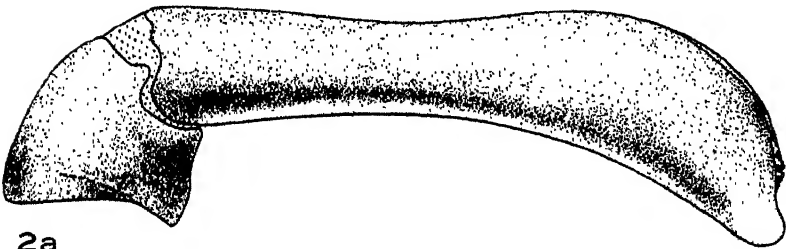
FIG. 2. *Margarinotus marginicollis* Le Conte. Structures as in fig. 1.



1a



b



2a



b

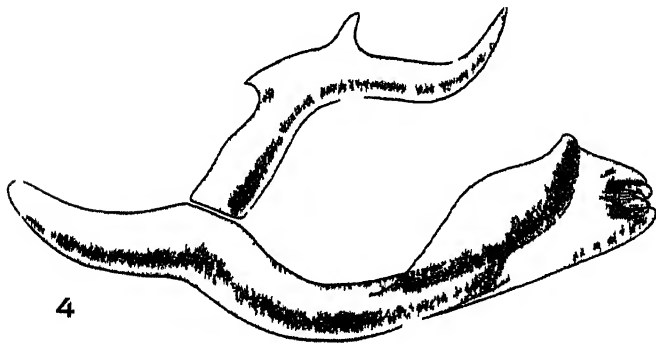
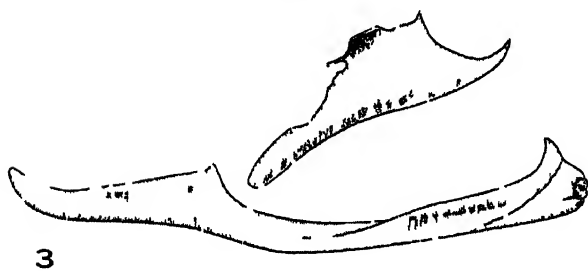
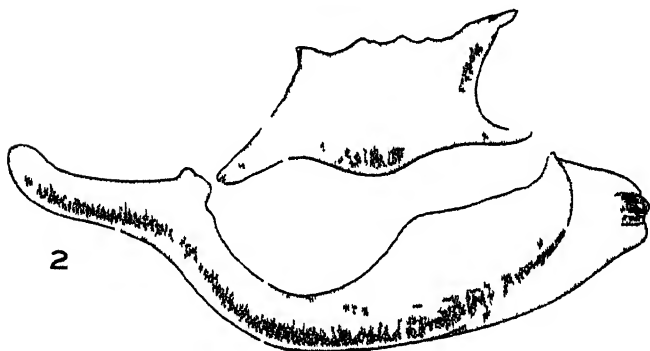
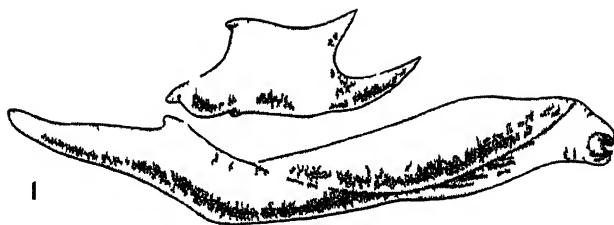
## PLATE 6

FIG 1 *Margarinotus guttifer* Horn Median lobe and armature of aedeagus,  
lateral view

FIG 2 *Margarinotus ballou* sp nov Structures as in fig 1

FIG 3 *Margarinotus weymanni* sp nov Structures as in fig 1

FIG 4 *Margarinotus cadaverinus* Hoffmann Structures as in fig 1



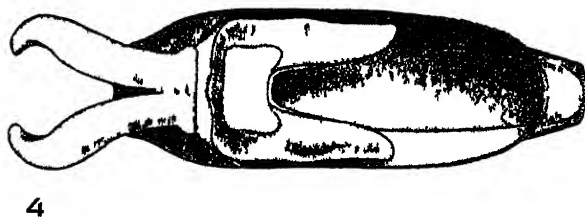
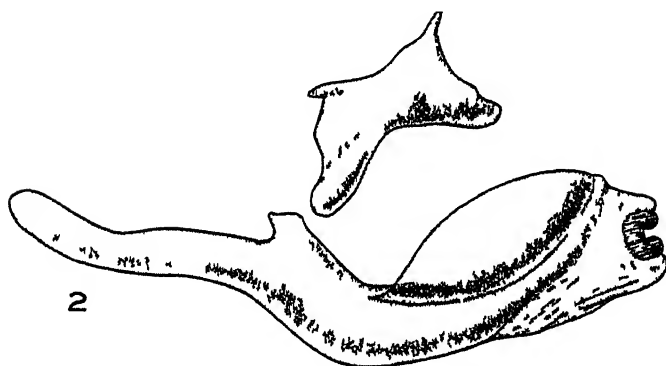
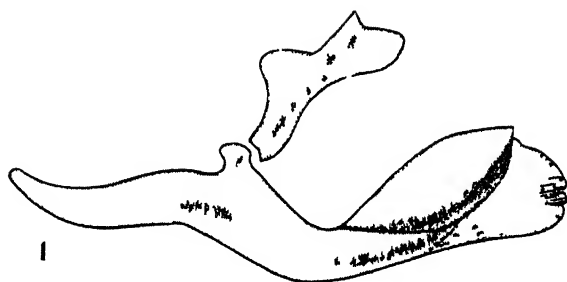
## PLATE 7

FIG 1 *Margarinotus striolides* sp nov Median lobe and armature of aedeagus, lateral view

FIG 2 *Margarinotus striola* Sahlberg Structures as in fig 1

FIG 3 *Margarinotus tristriatus* sp nov Lateral view of median lobe and armature

FIG 4 *Margarinotus tristriatus* sp nov Dorsal view of median lobe and armature

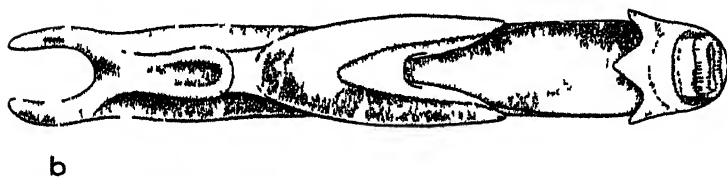
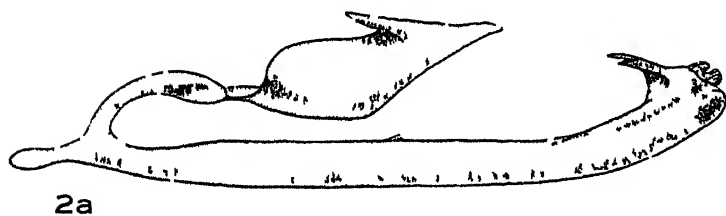
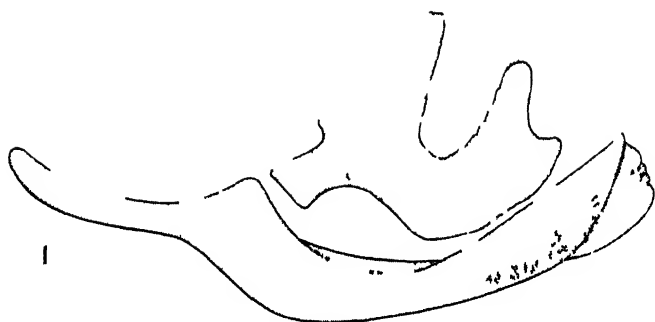


### PLATE 8

FIG. 1. *Margarinotus ussuriensis* Reichardt. Median lobe and armature of aedeagus, lateral view.

FIG. 2. *Margarinotus koenigi* Schmidt. *a*, Lateral, *b*, dorsal views of median lobe and armature.

FIG. 3. *Margarinotus lecontei* sp. nov. Median lobe and armature, lateral view.



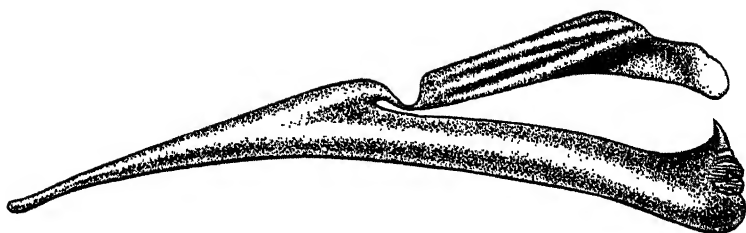


#### PLATE 9

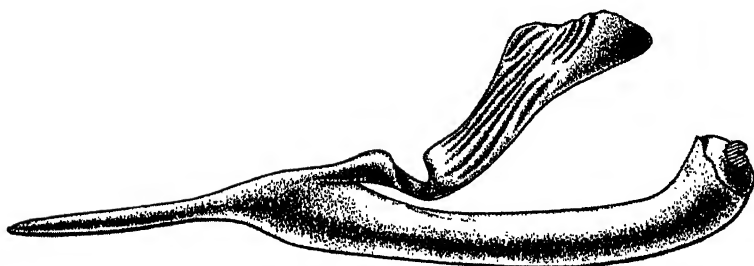
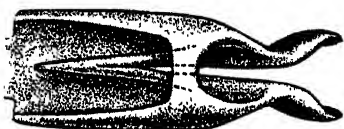
FIG. 1. *Margarinotus marginicollis* Le Conte. *a*, Median lobe and armature of aedeagus, lateral view. *b*, Median armature, dorsal view. *c*, Median lobe, dorsal view.

FIG. 2. *Margarinotus felipae* Lewis. Median lobe and armature, lateral view.

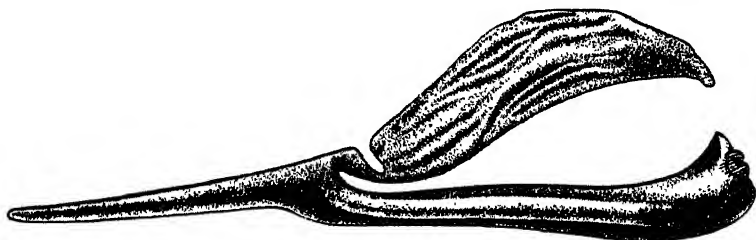
FIG. 3. *Margarinotus confusus* sp. nov. Structures as in fig. 2.



1a



2



3



# A NEW SUBFAMILY OF BEETLES PARASITIC ON MAMMALS

Staphylinidae, Amblyopininae

BY

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# A NEW SUBFAMILY OF BEETLES PARASITIC ON MAMMALS

BY CHARLES H. SEEVERS

It has been known for more than seventy years that certain South American rodents and marsupials harbor curious, ectoparasitic staphylinid beetles. More than a dozen species of *Amblyopinus* Solsky and *Edrabius* Fauvel have been recorded, yet surprisingly little is known about them, although ectoparasitism is an unusual mode of life among beetles.

The rarity of notes on the biology of these beetles is perhaps due to a misconception entertained by those in a position to make observations—the assumption that they are not truly parasitic. Undoubtedly many collectors have discarded specimens of *Amblyopinus* or have failed to make significant observations because they have had the impression that these staphylinids were merely attracted to trapped mammals.

Jelski, who first discovered *Amblyopinus* in Peru, noted (Solsky, 1875) that the beetles were frequently attached very firmly to the living mice—almost as tenaciously as ticks and lice. He observed that the hair was eroded from the backs of the mice and that the skin was tumefied and exuded a serous secretion. This early observation strongly indicated that *Amblyopinus* was not present on the mammals merely in the role of a scavenger or as a predator on other parasites. More recently, Zikán (1939) corroborated the observation that *Amblyopinus* may be firmly attached to the host, and concludes that these staphylinids are blood-sucking parasites. Although he gives no direct evidence to substantiate this viewpoint, the fact that the beetles imbed their mandibles so deeply within the skin that they are difficult to remove, suggests that they may feed upon body fluids. Zikán contends that the mouth parts are specialized for sucking blood, and maintains that they differ appreciably from those of other Staphylinidae. It is not evident to me in what respects they are distinctive, since many staphylinid beetles, especially of the subfamily Staphylininae, possess mouth parts similar in general structure. It is true that the mandibles are large and admirably suited for piercing (although not more so than those of many other

staphylinids) but the maxillae and labium do not exhibit any obvious specializations. The fact that their mouth parts may not be greatly different from other Staphylinidae does not, however, reflect adversely on the concept of *Amblyopinus* as a true blood-sucking parasite. The nature of the relationship of *Amblyopinus* to the mammals with which they live is a problem worthy of careful consideration.

One of the purposes of the present paper is to suggest a change in the systematic position of *Amblyopinus* and *Edrabius* within the Staphylinidae. Attempts to classify these genera have not been numerous and their history may be briefly outlined. Solsky (1875) assigned *Amblyopinus* to the Tachyporides with some hesitancy. Fauvel (1883) believed that the genus should be allied to *Habrocerus* Erichson, then grouped with the tachyporines. Matthews (1878) placed *Amblyopinus* in the Staphylini Genuini but withdrew this opinion (1884) in favor of the Tachyporine relationship. Fauvel's association of *Amblyopinus* and *Habrocerus* has been generally accepted, and after the subfamily Habrocerinae had been proposed by Ganglbauer (1895), *Amblyopinus* was tacitly included. Eichelbaum's (1909) catalogue of the staphylinid genera and subsequent catalogues have adopted this classification. The only dissenting opinion has been that of Notman (1923), who placed this group in the Trichophyinae.

It is my belief that *Amblyopinus* and *Edrabius* are not properly united with the Habrocerinae; they seem to occupy an isolated position in the Staphylinidae and probably merit subfamily status. The advanced degree to which these species are adapted to parasitism clearly suggests a rather extended period of ecological isolation. This appears to be reflected in morphological changes of subfamily significance.

The present paper also includes descriptions of new species of *Amblyopinus*, redescriptions of some of the less well-known species, a revised key, and new host records. The most recent review of *Amblyopinus* and *Edrabius* is that of Costa Lima (1936). It is concerned chiefly with the status of the species previously described and clears up several puzzling problems. Costa Lima gives a key to the species, full synonymy, and a complete list of references. His review of the species was necessarily incomplete, however, because several of the Andean species were not available. The species of *Amblyopinus* which are separated in his key on the basis of "having the front of the head emarginate" were not satisfactorily keyed out,

and the validity of several was questioned. The present studies are concerned chiefly with that group of species, and the revision of the key is restricted to the section dealing with them (from couplet 7 to the end of the key).

As a point of departure, it is considered advisable to redescribe *A. jelskii* Solsky, the genotype, since many important characteristics have been omitted from previous accounts. The validity of *fuegensis* Arrow, questioned by Costa Lima, is now believed established. The confusion revolving around *waterhousei* Fauvel, *henseli* Kolbe, and *bequaerti* Notman is partially eliminated; the latter two species are not synonymous with *waterhousei*, and probably are distinct from one another.

The discovery of *Amblyopinus schmidtii* sp. nov. in Guatemala appreciably extends the range of the genus, since no Central American records were heretofore known. The host range is also extended somewhat by new records. Marsupials and rodents are undoubtedly the principal hosts of the subfamily Amblyopininae, but we now have an instance of an individual of *A. sanborni* sp. nov. occurring on a bat (*Carollia perspicillata* L.). One cannot conclude from this isolated case that the bat is the usual host of this species, but the record is nonetheless interesting. The four closest allies of *sanborni* are parasitic on marsupials.

I am indebted to Mr. William J. Gerhard and Mr. Rupert L. Wenzel, of Field Museum, and Dr. J. C. Bequaert, of the Museum of Comparative Zoology, Cambridge, Massachusetts, for the opportunity of studying specimens in the collections of these institutions. All of the notes pertaining to the mammalian hosts were furnished by Mr. Karl P. Schmidt, of Field Museum; these are greatly appreciated. I am grateful to Dr. R. E. Blackwelder for identification of specimens of *Habrocerus* and for arranging a loan of examples of *Trichophya* from the United States National Museum.

### **Amblyopininae, subfam. nov.**

Antenna inserted behind the mandibular condyle and under the side margin of the vertex; antennal fossa visible only from the side (pl. 10, figs. 3, 5, 6). Anterior tentorial pits (pl. 10, fig. 2) immediately in front of the antennal fossae. Clypeus large. Frontal suture absent. Clypeus strongly deflexed in some species (pl. 10, fig. 7), in which case the labrum is invisible from above. Clypeus not deflexed in other species; in these instances the apex is emarginate and the labrum visible.



Eyes far back on the sides of the head in *Amblyopinus* (pl. 10, figs. 3, 5, 6); closer to the antennal fossae in *Edrabius*. Eyes variable; multifaceted in some species (with as many as twenty facets in *schmidti*), and without indication of facets in others (*henseli*, *bequaerti*, *gahani*).

Head constricted caudally to form a neck, the latter roughly delimited by the occipital suture, which extends across the dorsum and far down on the sides. Vertex subject to considerable variation at base; in some species (*waterhousei*, pl. 10, figs. 4, 5) it is elevated and caudally produced on each side of the neck so that the posterior face of the head is deeply concave.

Labrum (pl. 11, fig. 11) broadly emarginate. Antennae as illustrated by pl. 11, fig. 13. Mandibles (pl. 11, figs. 8, 9) large, tridentate. Maxilla (pl. 11, fig. 12) with a large, densely pilose galea and a short, hairy lacinia. Maxillary palpi four-segmented. Ventral aspect of the head rather generalized; the gula and submentum form a moderately broad, hourglass-shaped sclerite. Mentum (pl. 11, fig. 10) trapezoidal; glossae emarginate apically; paraglossal lobes moderately large. Labial palpi three-segmented.

Pronotum large, trapezoidal, all borders narrowly margined. Pronotal hypomera (pl. 12, fig. 15) moderately large, closely appressed to pronotum, postcoxal lobe absent. Elytra (pl. 12, figs. 16, 17) very short, scarcely deflexed laterally; epipleurae obsolescent. Apical margin of the combined elytra broadly and deeply emarginate, exposing the tergite of the second abdominal segment. Scutellum (pl. 12, fig. 16) large, overlapping and concealing a considerable area of the elytra. Apterous; no vestige of the wings present. Metanotal elements greatly reduced. Structures beneath the elytra illustrated in pl. 12, fig. 16; the largest element is apparently the tergite of the first abdominal segment (as the spiracle attests), while the metanotum seems to be represented by several indefinite structures between this and the scutellum.

Prosternum (pl. 12, fig. 15) short, fused laterally with the hypomera (sterno-notal suture absent). Anterior coxae very large, somewhat fusiform, moderately compressed dorso-ventrally. Mesosternum (pl. 12, fig. 18) short, scarcely extending between the coxae. Middle coxae very large, contiguous. Metasternum extremely short behind the middle coxae; produced medially over the inner part of the posterior coxae (these are not separated although fig. 18 may give that impression). Posterior coxae distinctive (pl. 12, figs. 18, 19); ventral surface broadly expanded to form a large lamella

which covers much of the femur and trochanter in repose; dorsal lamella of coxa absent.

Tarsi five-segmented. Prothoracic tarsi with four tarsomeres expanded and densely pilose beneath. Mesothoracic tarsi interspecifically variable and sexually dimorphic; in some species they resemble the anterior tarsi, and in others the pilosity of the slender tarsomeres is very sparse or absent. The slender metathoracic tarsi are not pilose beneath.

Abdomen generalized in its structure; segments 3-7 comprised of a tergite, two paratergites and a sternite. Eighth tergite of both sexes large, its apex strongly arcuate. Eighth sternite similar to the tergite in the female, deeply, arcuately emarginate in the male.

Female genitalia (pl. 12, fig. 22) comprised of lateral paraprocts, dorsal valvifers bearing coxites at their apices (styli absent), and a single ventral proctiger.

Ninth segment of male (concealed within eighth) comprised of a triangular-shaped tergite (its lateral margins strongly inflexed), two stout lateral plates which closely resemble the female paraprocts, and a narrow sternite with an emarginate apex. The lateral plates (which protrude from the abdominal apex) are not bridged dorsally or ventrally. Aedeagus (pl. 12, fig. 23) consists of a median lobe, the proximal part of which is bulbous, and two lateral lobes, which unite and articulate with the median lobe ventrally. The lateral lobes are separate for the most part and extend beyond the tip of the median lobe.

*Remarks.*—The beetles of the Amblyopininae are readily distinguished from all subfamilies of Staphylinidae save the Habrocerinae by the structure of the metathoracic coxae. A completely satisfactory comparison with the Habrocerinae is not possible at present because the characteristics of that group are not sufficiently known.

Pending a thorough investigation of the Habrocerinae, the present comparison amounts to contrasting *Amblyopinus* and *Habrocerus*. The latter genus, as based on the European genotype, *H. capillaricornis* Gravenhorst, and the closely allied North American species, *H. schwarzi* Horn, is clearly quite different from *Amblyopinus*.

The eighth and ninth abdominal segments of the male are generalized in *Amblyopinus* and profoundly modified in *Habrocerus* (for discussion and illustration of the male abdomen of *Habrocerus*, see Muir, 1920, and Blackwelder, 1936). In *Amblyopinus*, the frontal

suture is absent, and the elytral epipleurae are obsolescent; the species are completely apterous, and have the metanotum reduced to a few very indefinite elements. The head capsule and associated parts in these two genera exhibit numerous differences which in summary contradict the view of close relationship. A detailed comparison of the heads is not advisable, and it is hoped that the illustrations will serve to emphasize the morphological features of the Amblyopinine head; these as a whole are distinctive and unparalleled in the Staphylinidae. Superficially, the heads of some species of *Amblyopinus* bear a striking resemblance to those of *Leptinillus*, an ectoparasitic genus of Leptinidae found on North American mammals. This is apparently due to convergence and has no phylogenetic significance.

The above comparison is complicated somewhat by a Canadian species described by Le Conte as *Habrocerus magnus*. Dr. R. E. Blackwelder informs me that this species is probably not congeneric with the species of *Habrocerus*, and after comparison of *magnus* and *schwarzi* I agree fully with this view. For one thing, it appears (without dissection) as though the male of *magnus* does not have the specialized genital apparatus of *Habrocerus*. If this is true, and *magnus* is included in the Habrocerinae, the interpretation of the subfamily must be broadened considerably. As a whole, *magnus* shows greater structural similarity to *Amblyopinus* than do the species of *Habrocerus*. Even so, this does not alter my opinion that the Amblyopininae should be separated. Expanding the interpretation of the Habrocerinae to include *Amblyopinus* does not seem justified, since it is by no means evident that the Amblyopinine and Habrocerine stocks were derived from the same ancestral forms. A single criterion like the similarity in coxal structure is not sufficient to demonstrate relationship, since it may be a convergent development. In conclusion, the obligatory nature of their parasitism is strong evidence to support the view that the Amblyopininae have long been isolated.

The view that *Amblyopinus* is related to the Trichophyinae is untenable; the distinctions are so numerous that detailed treatment need not be given.

#### KEY TO THE SPECIES OF AMBLYOPINUS

1. Larger species; 15 mm. or more in length..... 2  
     Smaller species; less than 10 mm. in length..... 3
2. Pronotum strongly depressed laterally; elytra also depressed (Peru).  
     *mniszewski* Solsky
- Pronotum without lateral depressions; elytra convex (Peru)... *germaini* Fauvel

3. Clypeus strongly deflexed, labrum invisible from above (pl. 10, fig. 7); anterior "margin" of the head arcuate. . . . . 4  
 Clypeus not deflexed, its apical border emarginate; labrum visible; head not arcuate (pl. 10, figs. 2, 4) . . . . . 7
4. Head and pronotum opaque; basal margin of pronotum distinctly sinuate (British Guiana) . . . . . *angustus* Arrow  
 Head and pronotum shining; basal margin of pronotum straight. . . . . 5
5. First three abdominal sternites with a row of black, claviform scales along the margin. . . . . 6  
 Abdominal sternites without scales (Brazil) . . . . . *longus* Franz
6. Length 6.5–10 mm.; antennae and pronotum relatively shorter than those of the following species (Brazil, Argentina) . . . . . *gahani* Fauvel  
 Length 4–6 mm.; antennae and pronotum relatively longer (Brazil).  
*travassosi* Costa Lima
7. Apex of metathoracic tibia with a very stout, dentiform spine (pl. 12, fig. 26; Brazil) . . . . . *marmosae* sp. nov.  
 Metathoracic tibia without such a spine. . . . . 8
8. Eyes apparently composed of a single facet. . . . . 9  
 Eyes composed of more than one facet. . . . . 10
9. Fifth tarsomere of mesothoracic and metathoracic legs with a comb of spines on its inner margin; vertex of head with four setae (Brazil).  
*henseli* Kolbe  
 Fifth tarsomere without comb of spines; vertex without setae (Brazil).  
*bequaerti* Notman
10. Shape of head as illustrated by pl. 10, figs. 4, 5; its posterior surface deeply concave lateral to the neck; pronotum with basal row of four to six setae on each half . . . . . 11  
 Shape of head as illustrated by pl. 10, figs. 2, 3; its posterior surface not concave or very feebly so; pronotal base with not more than two setae on each half . . . . . 12
11. Head and pronotum with numerous shallow, crateriform pits; in addition, finely, closely, and reticulately strigulose (Peru) . . . . . *sanborni* sp. nov.  
 Head and pronotum punctate (punctures not at base of pits); also finely, closely, and transversely strigulose (Ecuador, Colombia).  
*waterhousei* Fauvel
12. Pronotal base with two setae on each half; pronotal shape as in pl. 12, fig. 21; scutellum three-fourths as long as broad (Chile) . . . *fuegensis* Arrow  
 Pronotal base with one seta near each posterior angle; pronotal shape as in pl. 12, fig. 20; scutellum one-half as long as broad. . . . . 13
13. Clypeal seta present; subocular bristle close to margin of eye (Peru).  
*jelskii* Solsky  
 Clypeal seta absent; subocular bristle some distance behind the eye (Guatemala) . . . . . *schmidtii* sp. nov.

### **Amblyopinus jelskii** Solsky (pl. 10, figs. 2, 3; pl. 12, fig. 20)

*Amblyopinus jelskii* Solsky, Hor. Soc. Ent. Ross., 11, p. 11, pl. 1, fig. 3, 1875—  
 Peru (Chanchamayo, Junín; near La Merced).

*Description.*—Color reddish-brown, elytra yellowish-brown, head and pronotum with a slight smoky tinge. Head and pronotum sparsely, irregularly, and moderately coarsely punctate; intervals finely and reticulately strigulose (the meshes of this reticulation are smaller on the pronotum where the connecting lines are more numerous). Scutellum reticulately strigulose; elytral surface not so. Abdominal sclerites densely and transversely strigulose, the fine lines much closer together than on head and thorax and with fewer connections. Elytra, scutellum, and abdomen with a moderately dense vestiture of recumbent, acicular setae; in some instances, especially along the apical margins of the sclerites, these become moderately spinose in character. There is a tendency for these recumbent setae to become sparser in the medial areas of the tergites.

Head with setae arranged as in pl. 10, figs. 2 and 3; one bristle on the lateral clypeal margin, one lateral to it on the ante-clypeus, one supra-antennal bristle, one supraocular bristle, one subocular bristle, one occipital bristle, and a series of finer setae caudal to the eye. Pronotum with one seta along the lateral margin a short distance in front of the middle, and one near each basal angle. Each elytron with one bristle on lateral margin behind the humerus. Tergites with a pair of erect setae on each half of the apical margin a little mesad of the lateral margin, the outermost one feeble. Sternites 3-7 with a single bristle on each half of the apical margin a short distance lateral to the middle (those of the third and fourth sternites very feeble or absent). Eighth sternite of female with three setae in longitudinal sequence on each side of the middle, the most caudal of the three more lateral in position and out of line with the others. Eighth male sternite with two setae on each side of the emargination.

Form of head illustrated by pl. 10, figs. 2 and 3. Clypeal emargination shallow. Side of head rather abruptly deflexed, the lateral margin of the head above the eye rounded so that it virtually conceals the eye from above. Vertex of head unmodified; not sulcate in front of occipital suture. Lateral to the neck, the posterior surface of the head gradually declivous and not concave.

Pronotal form illustrated by pl. 12, fig. 20. Scutellum one-half as long as broad, apex broadly and obtusely rounded.

First tarsomere of the male mesothoracic tarsus bearing a trace of white pile beneath; female tarsus not pilose.

*Measurement.*—Length 6-8 mm.

*Material examined.*—Three specimens from Cailloma, Arequipa, Peru: A female, collected from *Chinchillula sahamae* Thomas, August

24, 1939, by C. C. Sanborn; a male, collected from the same host, December 5, 1939, by Oliver Pearson (M.C.Z. coll.); a male, collected from *Akodon pulcherrimus* Thomas, August 25, 1939, by Karl P. Schmidt.

*Remarks.*—Previous host records of this species have not been satisfactory. The type series was collected by Jelski from several species of rodents inhabiting the mountains of central Peru. He first encountered these beetles on mice ("*Mus insectivora*") kept in a cage at Chanchamayo; they were attached to the skin in the manner of an acarid or a louse, according to him. The skin of the mice in the region of the tail was denuded, swollen, and exuded a serous secretion. Later he encountered the beetles in the puna zone, once in a mouse nest under a stone, and on another occasion on a dead mouse ("*Mus lobiceps*") in a trap. Apparently the names assigned by Jelski are valueless in determining the hosts of the type specimens.

The hosts recorded in this paper, *Chinchillula sahae* Thomas and *Akodon pulcherrimus* Thomas, are characteristic of the puna of southern Peru and northwestern Bolivia, and do not range much below 14,000 feet. The former is a soft-furred rodent nearly the size of a house rat, although short-tailed. It is coffee-colored above and white beneath. *Akodon pulcherrimus*, a rodent of mouse size, is the most brightly colored species of this widespread genus.

### ***Amblyopinus fuegensis* Arrow (pl. 12, fig. 21)**

*Amblyopinus fuegensis* Arrow, Ann. Mag. Nat. Hist., (7), 19, p. 126, 1907—Tierra del Fuego (Useless Bay region).

*Description.*—Surface of head medial to the eyes feebly convex; the eyes visible from above. Head and pronotum with fine, wavy, parallel strigulae in place of the reticulate strigulation of *jelskii*, and with irregular areas of vertex and pronotal disk smooth. Abdomen more closely and finely strigulose than in *jelskii*. Eyes separated from the posterior margin of the head by a distance equal to about one-half the length of the eye (the eye of *jelskii* is marginal). The supraocular bristle and subocular bristle of *jelskii* are more caudal in position (near margin of head) and are closer together than in *jelskii*. Basal margin of pronotum with two strong setae on each half (pl. 12, fig. 21). Pronotal shape differing from *jelskii* as illustrated by pl. 12, figs. 20, 21. Scutellum longer and narrower (three-fourths as long as broad) than that of *jelskii* (one-half as long as broad); apex approximately right-angled in contrast to the obtusely rounded apex of *jelskii*. First three tarsomeres of the male

mesothoracic tarsi densely pilose beneath. Sixth and seventh sternites of male with four long, black setae on each half of the apical margin and one on the lateral margin near apex. Eighth sternite of male with a group of four or five long bristles lateral to the apical emargination.

*Material examined*.—One male from Riesco Island, Magallanes, Chile, collected from *Ctenomys magellanicus* subsp., February 3, 1940, by J. M. Schmidt.

*Remarks*.—Arrow characterized *fuegensis* as differing from *jelskii* in these respects: Larger size; prothorax more circular, sides more curved, posterior angles less apparent; surface more shining, less punctured; elytra and abdomen less distinctly sculptured; scutellum larger, more angulated.

Because this description seemingly offers little of diagnostic value, Costa Lima questioned the validity of *fuegensis* and suspected it of being a synonym of *jelskii*. This does not appear to be true, however, since a specimen from Riesco Island (only a short distance from the type locality on Tierra del Fuego) agrees in all respects with Arrow's description and is certainly distinct from *jelskii*. The *Ctenomys* of Riesco Island is closely allied to the all but extinct *Ctenomys magellanicus* of southern Patagonia. Like all *Ctenomys* (the "tuco-tuco" of the Argentines), it is a burrowing rodent living an almost entirely subterranean life.

***Amblyopinus schmidti* sp. nov.**<sup>1</sup> (pl. 10, fig. 1; pl. 11; pl. 12, figs. 15–19, 22, 23)

*Type* from Santa Elena, Chimal, Guatemala. In the collection of Field Museum of Natural History. Male. Collected January 23, 1934, by Karl P. Schmidt and F. J. W. Schmidt.

*Paratypes*.—Six males and seven females from the same locality as the type, collected January 23, 1934, and January 26, 1934, by Karl P. Schmidt and F. J. W. Schmidt. One female from Volcan Tajumulco, Guatemala, collected February 18, 1934, by F. J. W. Schmidt. Seven in the collection of Field Museum of Natural History, one in the collection of the Museum of Comparative Zoology, and six in the collection of Charles H. Seevers.

*Host of type specimens*.—*Peromyscus guatemalensis* Merriam.

*Description*.—Coloration and sculpture as in *jelskii*. Upper surface of head medial to the eyes gradually declivous; eyes visible

<sup>1</sup> Named for the late F. J. W. Schmidt, mammalogist of the Mandel Guatemala Expedition of Field Museum, 1933–34.

from above. Clypeal setae absent; subocular bristle near the caudal margin of the head, some distance from the eye. Eyes smaller than those of *jelskii*, comprised of about twenty facets, situated a short distance from the posterior margin of the head. Plantar surface of mesothoracic tarsi of both sexes with a narrow strip of white pile beginning about the middle of the first tarsomere and extending on to the second and third; in *jelskii* only the first tarsomere of the male bears a trace of pilosity.

Sternites of third and fourth abdominal segments with a few very feeble, erect apical hairs; sternites 5-7 with four or five erect setae on each half of the apical margin (most of these feeble, usually only the innermost one moderately stout). Eighth sternite of female with three setae on each half, the two anterior ones in a transverse line and the third one near the apical margin (in *jelskii* the three are in longitudinal sequence, with the third one slightly out of line).

*Measurement*.—Length 6-7 mm.

*Remarks*.—*Peromyscus guatemalensis* Merriam is a white-footed mouse of the temperate zone in western Guatemala. Field Museum specimens are from Santa Elena, in the foggy cypress forest, at 9,500 feet altitude, and from Volcan Tajumulco, at 10,400 feet. It is a large species, with rather long dark fur.

### **Amblyopinus waterhousei** Fauvel (pl. 10, figs. 4, 5)

*Amblyopinus waterhousei* Fauvel, Revue d'Ent., 19, p. 64, 1900—Ecuador (Riobamba and Cuenca).

*Description*.—Light reddish-brown, head and pronotum highly polished, elytra and abdomen considerably less so. Head, pronotum, and abdomen finely strigulose, the strigulae close together, parallel, predominantly transverse (frequently the entire pattern is undulating), and with connecting lines relatively infrequent. Head and pronotum sparsely punctate, the punctation of the pronotum finer.

Head (pl. 10, figs. 4, 5) differing in numerous respects from *jelskii*. Clypeal margin deeply and arcuately emarginate. Upper surface of head medial to the eye rather strongly declivous for some distance. Vertex notably different from *jelskii*, this region prominently elevated and produced caudally, delimited from the neck by a transverse sulcus immediately in front of the occipital suture. Lateral to the neck, the posterior surface of the head is deeply concave; the concavities receive the apical angles of the pronotum, which may be partially obscured from above by the overhanging



vertex. Eyes oval, smaller than those of *jelskii*, comprised of about ten facets, situated a short distance from the margin.

Clypeal bristle absent. Supraocular and subocular bristles situated near the posterior margin of the head. Pronotum with one long bristle on the lateral margin about one-third of the distance from apex to base, and four to six bristles along each half of the basal margin. In addition to these long bristles, the pronotum has a row (internal to the raised marginal line) of about 13–14 short setae beginning on the anterior border and continuing along the sides. Elytra with one seta near the lateral margin behind the humerus. Tergites with a pair of setae on the apical margin near each side. Sternites 5–7 bearing a single marginal seta on each side.

Greatest elytral length at a point about two-thirds the distance from median line to lateral margin. Punctuation of elytra coarse, sparse, approximately one-half as dense as in *jelskii*. Elytral surface with only the slightest suggestion of sculpturing.

Mesothoracic tarsi with the first four tarsomeres densely pilose beneath in both sexes.

*Measurement*.—Length 7.5–10 mm.

*Material examined*.—Four males and one female from El Calvario, Meta, Colombia, collected from *Didelphis paraguayensis meridensis* Oken, November 20, 1939, by Dr. Ernesto Osorno (M.C.Z. coll.).

*Remarks*.—*Didelphis paraguayensis meridensis* Oken is an opossum, in general appearance much like the common opossum of the southeastern United States, and with very similar but softer and thicker fur. It is largely arboreal in its habits and ranges at higher altitudes than the common species.

### ***Amblyopinus sanborni* sp. nov.**

*Type* from Segrario, Puno, Peru. In the collection of Field Museum of Natural History. Female. Collected October 10, 1941, by C. C. Sanborn.

*Host of type*.—*Carollia perspicillata* Linnaeus.

*Description*.—Dark reddish-brown. Head and pronotum with numerous small, shallow, irregularly arranged, crateriform impressions, very finely punctured at base. Surface of head and pronotum sculptured with a fine, irregular reticulate (often hexagonal) strigulation. Pronotum with a medial, feebly elevated, incomplete line. Head and pronotum feebly shining. Chaetotaxy of the head and

pronotum as in *waterhousei*; the pronotal base with six setae on each half. Eyes comprised of approximately eight facets; circular in outline.

Structure of the head similar to *waterhousei*, differing only in minor details. Apical margin of the clypeus more feebly emarginate than in *waterhousei*. Lateral margin of the head straight (as seen from above); in *waterhousei* bisinuate. Head smaller in proportion to the body than in *waterhousei*; its greatest width is approximately the same as the length of the pronotum (in *waterhousei* the head is laterally produced at the eye level and its width is one and one-fifth times the pronotal length). Length of head three-fifths the pronotal length (in *waterhousei* four-fifths the pronotal length).

Apical margin of each elytron angulate, the apex of the angle attained (point of maximum elytral length) about four-fifths of the distance from the median line to the side.

*Measurement*.—Length 7 mm.

*Remarks*.—*Carollia perspicillata* Linnaeus, from which a single example of this species was collected, is a widespread and common bat in tropical South America, ranging well into the Andean valleys, as at Segrario.

It will be of interest to discover whether this occurrence of *Amblyopinus* on a bat was a fortuitous or normal relationship. If the latter is true, it will be quite noteworthy in view of the fact that the species most closely allied to *sanborni* (*waterhousei*, *henseli*, *bequaerti*, *marmosae*) occur on marsupials.

### *Amblyopinus henseli* Kolbe

*Amblyopinus henseli* Kolbe, Deut. Ent. Nat. Bibl., 2, p. 117, 1911—Brazil (Rio Grande do Sul, or Rio de Janeiro).

*Amblyopinus henseli* Franz, Abh. Senckenb. Naturf. Ges., 40, p. 405, 4 figs., 1927.

*Amblyopinus henseli* Zikán, Rev. Ent., 10, p. 222, 8 figs., 1939.

There has been considerable confusion with regard to the identity and status of *henseli*, *bequaerti*, and *waterhousei*. Costa Lima (1936) states that *bequaerti* is identical with *henseli* and that both are probably synonyms of *waterhousei*.

Kolbe's original description of *henseli* was inadequate, and the additional notes and figures of Franz, who examined the types and a few other specimens, do not contribute much information about this species. The types were collected from a species of *Didelphis*,

but Franz identified specimens taken from *Metachirus opossum* L. as *henseli* also. Franz noted considerable variation in the series before him but was unable to conclude that more than one species was represented. Subsequent writers have also identified beetles from several Brazilian mammals as *henseli*: from *Didelphis aurita* Wied (Costa Lima, 1936; Fonseca, 1939); from *Metachirus opossum* L. (Costa Lima; Zikán, 1939); from a mammal designated as "rato silvestre" (Costa Lima). Zikán redescribed and figured *henseli* in some detail from specimens identified as that species by Costa Lima.

Notman (1923) based *bequaerti* on specimens collected from *Monodelphis* sp. at Itatiaya, Rio de Janeiro, Brazil. Costa Lima concluded that *bequaerti* is synonymous with *henseli* since Notman's description does not present any significant differences from the descriptions of *henseli* by Kolbe and Franz. This is no doubt true and there has been no substantial reason to regard *bequaerti* as valid. But in view of Zikán's description of *henseli*, the validity of *bequaerti* is not nearly so questionable, for it differs in a number of respects from that description. If the specimens examined by Zikán are indeed *henseli*, a point which has by no means been established beyond doubt, then *bequaerti* is apparently a valid species. Since several genera of marsupials (*Didelphis*, *Metachirus*, and *Monodelphis*) are involved as hosts in this situation, it is very probable that more species of *Amblyopinus* are concerned than has been suspected. I am unable to contribute to the solution of the problem except by redescribing a paratype of *bequaerti* and calling attention to the differences between it and Zikán's *henseli*.

There is little doubt that *henseli* and *bequaerti* are quite distinct from *waterhousei*. The last is larger, much darker, and exhibits many differences in chaetotaxy, sculpture, and head structure. The head of *waterhousei* is rather sharply delimited from the neck by a moderately deep sulcus; in the others this is very feebly indicated. The posterior face of the head (lateral to the neck) is much more deeply concave in *waterhousei*. The eyes of *waterhousei* are composed of about ten facets; those of *bequaerti* and *henseli* are very small and not divided into facets. The chaetotaxy and sculpturing of *waterhousei* and *bequaerti* are described elsewhere and need not be compared in detail here.

***Amblyopinus bequaerti* Notman (pl. 10, fig. 6; pl. 12, fig. 24)**

*Omaloxenus bequaerti* Notman, Amer. Mus. Nat. Hist., Nov., No. 68, p. 1, 1928—Brazil (Itatiaya).

Examination of a paratype of *bequaerti* reveals that it differs from Zikán's description of *henseli* in the following respects: The four setae of the vertex are absent; the two long, curved setae of the cardo are absent; the gula has two very long, black setae near the apical margin and a number of fine pale hairs (none of which are noteworthy), while *henseli* has eight moderately conspicuous setae on the gula; the middle tibia is beset with about fourteen stout spines (exclusive of the apical row) arranged in about five irregular, longitudinal rows, while *henseli* seems to have four spines on its inner margin and one on its outer surface; the fifth tarsomeres of the mesothoracic and metathoracic legs lack the comb of spines on their inner margins. In *henseli* this comb is comprised of about eight spines (Zikán, 1939, fig. 1) and is apparently an adaptation for clinging to fur.

It seems advisable to supplement the above comparison with some descriptive notes:

Coloration rufotestaceous, elytra yellow. Head with moderately dense, coarse punctation; surface obsoletely strigulose, the fine lines appearing faintly on the medial areas and more regularly laterad. Pronotum more finely and sparsely punctured; surface very finely, reticulately strigulose; surface with a moderate number of low, smooth, irregularly longitudinal elevations. Elytral surface with a fine, reticulate strigulation between the coarse, irregular punctures. Pronotum with two long bristles along the basal margin near each posterior angle. Elytra with numerous recumbent, acicular setae interspersed with many definitely spinose setae which tend to become more numerous near the suture. Tergites 3-7 with three long setae (as a rule) on apical margin, the outermost one feeble, the two more medial ones stouter, darker. Apex of tergites with a row of closely set, short, acicular setae interspersed with longer ones at rather regular intervals (pl. 12, fig. 24). Third sternite with one strong apical bristle near lateral margin and several very fine ones more medially. Sternites 4-7 with six or seven apical setae on each half, the outermost ones strong on all of the sternites, but the more medial ones weak on the fourth sternite and stouter on the more caudal sternites. Apex of eighth male sternite deeply emarginate.

***Amblyopinus marmosae* sp. nov. (pl. 12, figs. 25, 26)**

*Type* from Apiahy, São Paulo, Brazil. In the collection of the Museum of Comparative Zoology. Collected September 4, 1929, by George Allen.

*Paratype*.—One male, same data as the type, in the collection of Charles H. Seevers.

*Host*.—*Marmosa incana paulensis* Tate.

*Description*.—Testaceous. Head and thorax strongly shining. Surface of head and pronotum with numerous shallow, irregularly arranged, crateriform impressions (broad, shallow pits), often more or less confluent. Head and pronotum strigulose, the fine lines forming an extensive, finely meshed reticulation.

Chaetotaxy of the head as follows: A pair of short clypeal setae (one on lateral margin, another a short distance mesad); one long bristle on margin of vertex, caudad of antennal insertion; a short subantennal seta; a very long subocular bristle; a long supraocular bristle; a long bristle on the caudal margin of the dorsum and a short seta medial to it; a pair of very long gular bristles and a few pale setae lateral to them; a single postgenal seta behind the cardo. Pronotum with a long seta on the lateral margin and one near the posterior angle. In addition, the pronotum with a submarginal row (beginning on anterior margin and continuing along lateral and posterior margins) of nineteen or twenty short setae. Elytra with one long seta on lateral margin, sparsely beset with recumbent, acicular setae; distinctly spinose setae infrequent, more or less restricted to apex.

Tergites sparsely setose, especially medially. Apex of tergites beset with a row of short, sparsely arranged, acicular setae irregularly placed between longer setae (pl. 12, fig. 25). Tergites 3–7 with two long apical bristles near each side, the outer one very fine, pale, the inner one stouter, darker. Eighth male tergite with four long setae near each lateral margin. Sternites 3–5 with one long, black, erect bristle near each apical angle and several fine, erect bristles along the apical border. Sternites 6–7 with an apical row of six or seven long bristles on each half, the majority of these moderately stout and dark, a few very slender.

Eyes moderately large (nearly four times as large as those of *bequaerti*), very indistinctly faceted; under certain conditions of illumination, division into eight or more areas may be faintly discerned.

Posterior surface of the head, lateral to the neck, scarcely concave.

Anterior tibia unarmed; middle tibia with nine relatively stout spines on the ventral surface and one on the lateral margin; posterior tibia bearing four spines on the ventral surface. Metathoracic tibia

with a very stout, dentiform spine at apex (pl. 12, fig. 26) in addition to the apical row of smaller spines. Fifth tarsomere of the middle and posterior legs with a comb of spines on its inner margin, the mesothoracic tarsal comb of six or seven spines, the metathoracic tarsal comb of about twelve spines arranged in two irregular rows.

Apex of eighth male sternite feebly emarginate.

*Measurement*.—Length 4.5–5 mm.

*Remarks*.—*A. marmosae* is most closely allied to *henseli* and *bequaerti*. It is observed to differ from *bequaerti* in numerous respects: smaller size; paler coloration; different sculpture of the head and pronotum; larger eyes, indistinctly faceted; only one long bristle on basal margin of pronotum; the recumbent setae of the elytra approximately one-half as numerous, and spinose setae infrequently present; the short, acicular setae of the apical margins of the tergites much sparser; the tergites with only two long, erect bristles on apical margin; the presence of the stout, dentiform spine at apex of posterior tibia; the presence of the comb of spines on the fifth tarsomere of the middle and posterior legs; the eighth male sternite much more feebly emarginate. There are probably numerous differences between *marmosae* and *henseli*. The presence of the very stout spine at the apex of the posterior tibia should distinguish this species from *henseli*. It is of interest to note that, like *henseli*, it possesses the tarsal comb of spines.

*Marmosa incana paulensis* Tate, a rather typical mouse-opossum, is found in the Organ Mountains and other nearby ranges in the states of Rio de Janeiro and São Paulo. The forests in this area have a rich undergrowth of bracken and other ferns.

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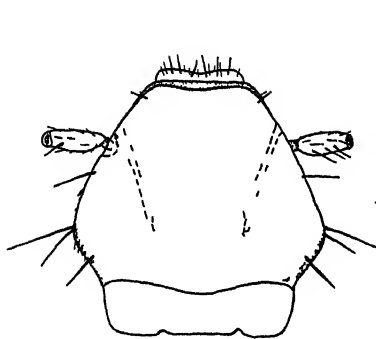
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# PLATES

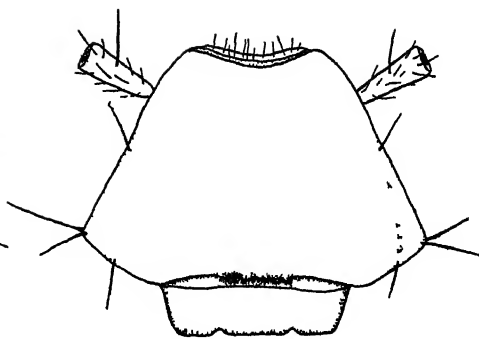


PLATE 10

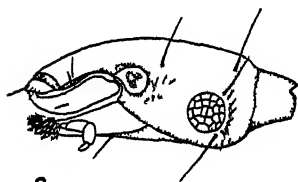
- FIG. 1. *Amblyopinus schmidtii* sp. nov.  
FIG. 2. *Amblyopinus jelskii* Solsky, dorsal view of head.  
FIG. 3. *Amblyopinus jelskii* Solsky, lateral view of head.  
FIG. 4. *Amblyopinus waterhousei* Fauvel, dorsal view of head.  
FIG. 5. *Amblyopinus waterhousei* Fauvel, lateral view of head.  
FIG. 6. *Amblyopinus bequaerti* Notman, lateral view of head.  
FIG. 7. *Amblyopinus gahani* Fauvel, dorsal view of head.



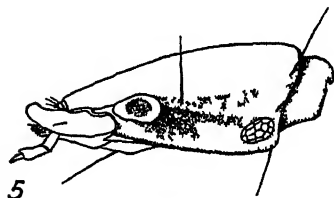
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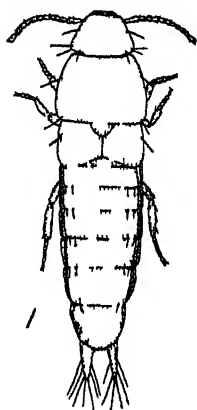
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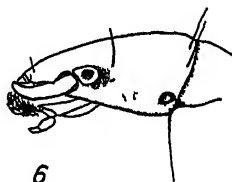
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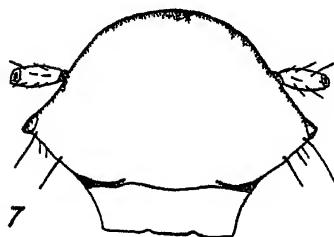
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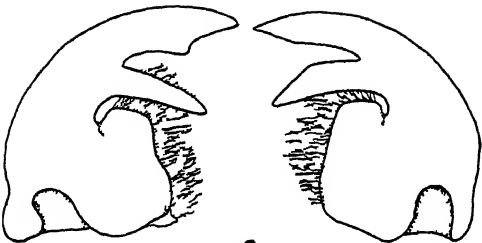


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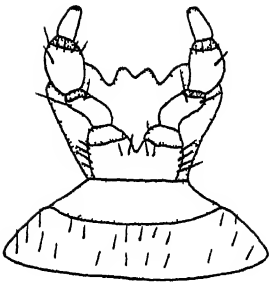
PLATE 11

*Amblyopinus schmidt* sp. nov.

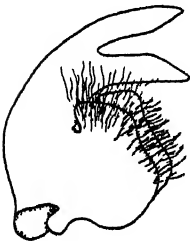
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|--------------------------------------|----------------|
| FIG 8 Dorsal view of mandibles       | FIG 11 Labrum  |
| FIG 9 Ventral view of right mandible | FIG 12 Maxilla |
| FIG 10 Labium                        | FIG 13 Antenna |
| FIG 14 Ventral view of head          |                |



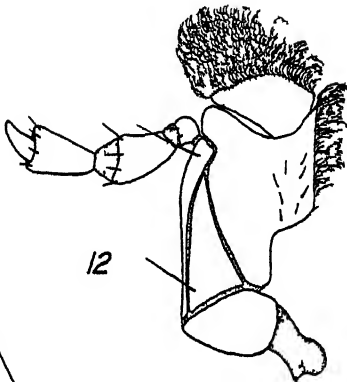
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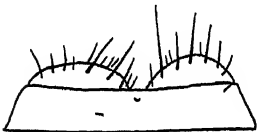
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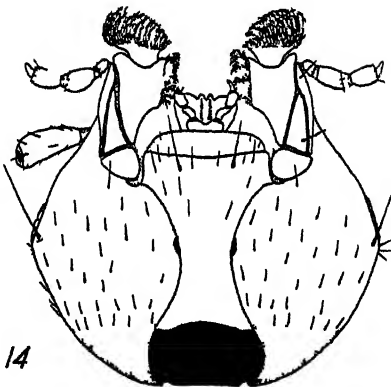
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## PLATE 12

### *Amblyopinus schmidtii* sp. nov.

FIG. 15. Ventral view of prothorax.

FIG. 16. Dorsal view of mesothorax, metathorax, and first abdominal tergite.

FIG. 17. Under surface of elytron.

FIG. 18. Ventral view of mesothorax and metathorax.

FIG. 19. Right metathoracic coxa.

FIG. 22. Dorsal view of female genitalia.

FIG. 23. Lateral view of male genital tube, with an enlargement of inner surface of apex of lateral lobe.

### *Amblyopinus jelskii* Solsky

FIG. 20. Outline of pronotum.

### *Amblyopinus fuegensis* Arrow

FIG. 21. Outline of pronotum.

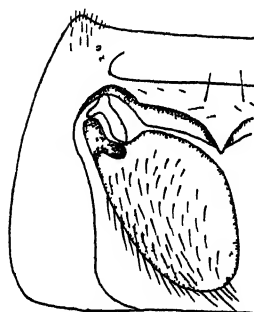
### *Amblyopinus marmosae* sp. nov.

FIG. 25. Apical margin of tergite.

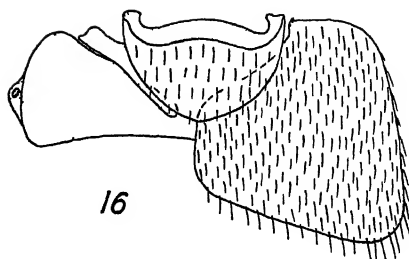
FIG. 26. Apex of metathoracic tibia.

### *Amblyopinus bequaerti* Notman

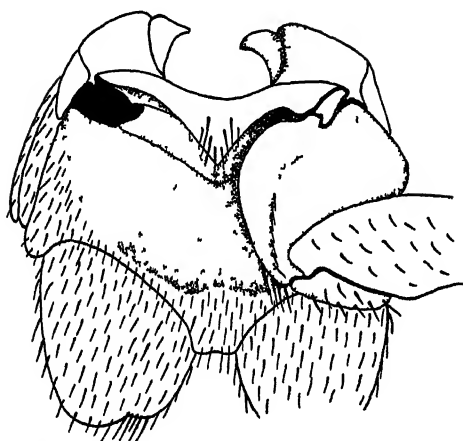
FIG. 24. Apical margin of tergite.



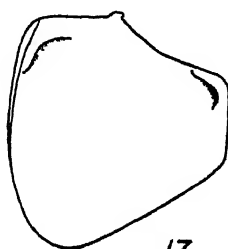
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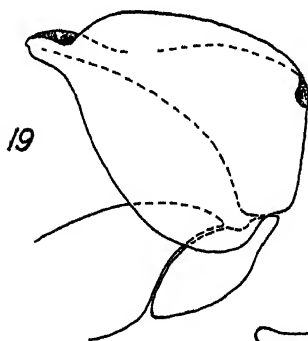
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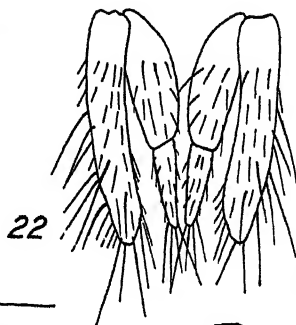
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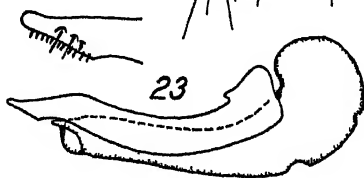
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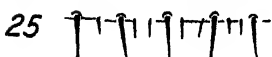
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# CHILOPODS IN THE COLLECTIONS OF FIELD MUSEUM OF NATURAL HISTORY

BY

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DEPARTMENT OF ZOOLOGY, UNIVERSITY OF UTAH



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# CHILOPODS IN THE COLLECTIONS OF FIELD MUSEUM OF NATURAL HISTORY

BY RALPH V CHAMBERLIN

The present publication lists the centipeds in the collections of Field Museum of Natural History and includes descriptions of twenty-four new species represented there. For the privilege of studying this material I am indebted to Colonel Clifford C. Gregg, Director; Mr. Karl Schmidt, Chief Curator, Department of Zoology; and Mr. William J. Gerhard, Curator of Insects. A large proportion of the collection is due to the interest of Mr. Schmidt in this group of animals. In addition to material obtained through local field work in the vicinity of Chicago and field collecting in various parts of the United States, the collection represents the accumulation from the Marshall Field Brazilian Expedition, 1926-27; the Crane Pacific Expedition, 1928-29; the Mandel Guatemala Expedition, 1933-34; and the Field Museum Magellanic Expedition, 1939-40. Duplicate specimens have been retained by the author.

## Order Scolopendrida

### Family Cryptopidae

#### **Cryptops diego** sp. nov.

*Type* from San Diego (Balboa Park), California. Collected August 25, 1940, by Morton Moran.

*Description.*—Light orange in color, the head and posterior legs a darker orange. Head longer than wide, widest near middle; punctate; without paired sulci. First dorsal plate overlapping the posterior border of the head; without either transverse or paired longitudinal sulci. Paired longitudinal sulci complete from seventh to twentieth tergites inclusive; sulci also present on sixth tergite but incomplete anteriorly. Ventral plates typically with a curved transverse sulcus near middle, its concavity cephalad; this crossed by a median longitudinal sulcus which does not extend over either anterior or posterior border. Last ventral plate moderately narrowed caudad, its caudal margin wide and straight.

Coxopleura with inner posterior corner not at all produced; with several spinules along caudal border, these somewhat more slender than those on femora or anal legs; surface otherwise free from spinules; poriferous area not reaching caudal or mesal border. Anterior spiracles large, subcircular or broadly longitudinally elliptic.

Femur of anal legs with numerous short spines beneath, with a narrow median longitudinal naked area beneath over distal half or more. Fourth joint with numerous similar spines beneath and a longitudinal naked area beneath over entire length, without teeth; fifth joint with a series of five teeth beneath; first tarsal joint with two teeth.

### **Cryptops hyalinus Say**

*Cryptops hyalina* Say, Journ. Acad. Nat. Sci. Phila., 2, p. 111, 1821.

Arkansas: Delight, Pike County, 1, April 16, 1941 (K. P. Schmidt).

Tennessee: Great Smoky Mountains National Park, Greenbrier Cove, 1, June 14, 1942 (H. S. Dybas).

### **Newportia stollii Pocock**

*Scolopendrides stollii* Pocock, Biol. Centr.-Amer., Chilopoda and Diplopoda, p. 31, 1896.

*Newportia stollii* Kraepelin, Rev. Scolopendriden, p. 85, 1903.

Guatemala: Bobos (Playitas), Izabal, 1, December 20, 1933 (K. P. Schmidt).

### **Otocryptops ferrugineus Linnaeus**

*Scolopendra ferruginea* Linnaeus, Syst. Nat., 12th ed., p. 1063, 1767.

*Scolopocryptops ferruginea* Newport, Trans. Linn. Soc. Lond., 19, p. 406, 1845.

*Otocryptops ferrugineus* Kraepelin, Rev. Scolopendriden, p. 72, 1903.

Guatemala: Chichivac, 11, February 17, 1934; Volcan Tajumulco, 1, February 16 and 18, 1934, in bromeliad, 7,000-9,000 feet (K. P. Schmidt and F. J. W. Schmidt).

### **Otocryptops sexspinosus Say**

*Cryptops sexspinosus* Say, Journ. Acad. Nat. Sci. Phila., 2, p. 112, 1821.

*Scolopocryptops sexspinosus* Newport, Trans. Linn. Soc. Lond., 19, p. 407, 1845.

*Otocryptops sexspinosus* Kraepelin, Rev. Scolopendriden, p. 72, 1903.

California: Los Angeles, Los Angeles County, 7, 1936-38 (Gordon Grant).

Missouri: Libertyville, St. Francois County, 1, April 2, 1937 (K. P. Schmidt).

Arkansas: Base of Rich Mountain, Polk County, 10, March 22-23, 1938 (K. P. Schmidt); Imboden, Lawrence County, 1, April 3, 1937 (K. P. Schmidt); three miles east of Delight, Pike County, 1 (J. M. Schmidt).

Tennessee: Great Smoky Mountains National Park, Gatlinburg, 7, June 13, 1942; Greenbrier Cove, 3, June 14, 1942 (H. S. Dybas).

Illinois: Olive Branch, Alexander County, 1, May 10, 1907 (C. M. Barber); Palos Park, Cook County, 1, Monee, Will County, 1, March 24, 1908 (Henry Ramstadt); Highland Park, Lake County, 1, October 12, 1924 (C. C. Sanborn and K. P. Schmidt).

Georgia: Thomasville, Thomas County, 1, June, 1939 (Mrs. Robb White).

Indiana: Annapolis, Parke County, 1, October 20, 1940 (R. L. Wenzel).

Washington: Happy Lake, Olympic Mountains, Jefferson County, 1 (D. G. Elliot).

### **Otocryptops melanostomus** Newport

*Scolopocryptops melanostomus* Newport, Trans. Linn. Soc. Lond., 19, p. 406, 1845.

*Otocryptops melanostomus* Kraepelin, Rev. Scolopendriden, p. 74, 1903.

Haiti: Kenskoff, 4,500 feet, 5, under stones, December 2, 1928 (K. P. Schmidt).

Guatemala: Escobas, Izabal, 1, November 25, 1938 (K. P. Schmidt).

Venezuela: Probably Caracas, 1, 1942 (Hermano Irénee).

### **Theatops spinicaudus** Wood

*Opisthemega spinicauda* Wood, Journ. Acad. Nat. Sci. Phila., 5, p. 36, 1863.

*Theatops spinicaudus* Bollman, Ent. Americana, 4, p. 6, 1888.

Arkansas: Eleven miles west of Hot Springs, Garland County, 2, March, 1938; two miles east of Ben Lomond, Sevier County, 1, northeast corner of Mount Magazine, Logan County, 1, March 24, 1938; seven miles north of Arkadelphia, Clark County, 2, April 7, 1937; Delight, Pike County, 1, April 16, 1941 (all collected by K. P. Schmidt); three miles east of Delight, 1 (J. M. Schmidt).

Tennessee: Great Smoky Mountains National Park, Gatlinburg, 6, June 13, 1941; Greenbrier Cove, 1, June 14, 1942 (H. S. Dybas).

Missouri: Libertyville, St. Francois County, 41, April 2, 1937 (K. P. Schmidt).

Illinois: Alto Pass, Union County, 1, April 21-29, 1928 (Bryan Patterson).

### **Theatops posticus Say**

*Cryptops postica* Say, Journ. Acad. Nat. Sci. Phila., 2, p. 112, 1821.

*Theatops postica* Newport, Trans. Linn. Soc. Lond., 19, p. 411, 1845.

Arizona: Rincon Mountain, September 23 30, 1907 (H. S. Swarth).

### **Scolopocryptops miersii Newport**

*Scolopocryptops miersii* Newport, Trans. Linn. Soc. Lond., 19, p. 405, 1845.

Argentina: Caraguatay, Paraná River, Misiones, 1, September 11, 1926 (K. P. Schmidt).

## **Family Otostigmidae**

### **Otostigmus inermis Porath**

*Otostigmus inermis* Porath, Bih., Svensk. Vetensk.-Akad. Handl., (2), 4, No. 7, p. 23, 1876.

Colombia: Region of Santa Marta, 1, August 6, 1902 (H. N. Howland).

### **Otostigmus sp.**

Belgian Congo: Irumu, savanna country, 4,200 feet, 1 (lacking anal legs), August, 1924 (Edmund Heller).

### **Otostigmus scaber Porath**

*Otostigmus scaber* Porath, Bih., Svensk. Vetensk.-Akad. Handl., (2), 4, No. 7, p. 20, 1876.

China: Wong Go Ya, Szechwan, 1 (with most of its legs lost, but conforming in other characters with this species; F. T. Smith).

### **Otostigmus calcanus sp. nov.**

*Type* from Hacienda Urco, near Calca, Cuzco, Peru. Collected September 19, 1939, by K. P. Schmidt.

*Paratypes.* Two specimens collected with the type "under stones near water."

*Description.* Olive in color, the head and adjacent plates of dorsum darker. Legs and antennae also olivaceous. Antennae composed in one specimen of sixteen (left) or seventeen (right) segments, but normally seventeen; first  $2\frac{1}{3}$  segments glabrous. Head finely punctate. Prosternum with indication of four teeth on each side, but of these the three innermost more or less completely fused, only the outermost free. Dorsal plates with paired sulci complete from fifth segment caudad. Only the last plate laterally margined. Last plate with caudal margin obtusely angular, the sides of angle straight; without sulcus or impression. All tergites wholly smooth.

Paired sulci on anterior ventral plates extending only across anterior border, on those plates behind middle the sulci reaching nearly to middle; on none complete. Last ventral plate moderately narrowed caudad; caudal margin between rounded corners rather wide and nearly straight; without median sulcus or impression.

Coxopleura posteriorly truncate, not at all produced and wholly without spines. Legs of first pair with two tarsal spines; others to and including the nineteenth with one tarsal spine.

Femur of anal legs wholly lacking spines; a broad longitudinal depression or furrow usually showing over about the distal two-thirds of ventral surface into which furrow the next segment fits when flexed.

Length about 30 mm.

*Remarks.* Having some resemblances to *O. tibialis* Brol. but differing conspicuously in lacking the peculiar modification of the tibia in the anal legs of the latter. It is a much smaller form.

### **Otostigmus therezopolis sp. nov.**

*Type* from five miles north of Therezopolis, Rio de Janeiro, Brazil. Altitude 3,500 feet. Collected under a log July 5, 1926, by K. P. Schmidt.

*Paratypes.*—Two specimens, Therezopolis, July 9, 1926, K. P. Schmidt.

*Description.*—General color olivaceous, with the legs paler than body. Head and first or first and second dorsal plates more or less chestnut. Antennae of type composed of eighteen (right) or nineteen (left) segments of which the first  $2\frac{1}{3}$ – $2\frac{1}{4}$  are glabrous. Cephalic plate with punctae lightly impressed, not numerous. Dorsal plates

with paired sulci complete from the seventh caudad. Only the last dorsal plate distinctly margined laterally. Last dorsal plate strongly produced caudad, the posterior angle narrowly rounded and slightly notched at middle; without sulcus or depression. All dorsal plates smooth, without trace of ridges or prickles. Ventral plates smooth. None with complete paired sulci, these short, crossing anterior border only. Last ventral plate considerably narrowed caudad; caudal margin slightly incurved at middle; surface smooth.

Coxopleura posteriorly truncate except at inner angle where they are a little produced; wholly lacking spines. First sixteen pairs of legs with two tarsal spines; the remaining legs, to and including the twentieth, with a single tarsal spine. Anal legs wholly lacking spines.

Length 50 mm.

*Remarks.*—This species seems nearest to *O. caraibicus* Kraepelin but differs in having a tarsal spine on the twentieth legs, in the shorter, paired sulci of the sternites, etc.

### **Otostigmus greggi<sup>1</sup> sp. nov.**

*Type* from Hog Harbor, Espiritu Santo Island, New Hebrides. Collected April 5, 1929, by K. P. Schmidt.

*Description.*—General color olive, the legs and antennae paler than dorsum; head a somewhat light chestnut, lighter in front of frontal suture. Antennae of holotype composed of twenty (left) and twenty-one (right) segments of which the first  $2\frac{1}{4}$  are glabrous; cephalic plate punctate. Dorsal plates bisulcate beginning with the fifth and margined from the ninth caudad, the eighth with weaker indication of margining sulcus. Tergites otherwise smooth. Last tergite strongly margined laterally; posterior portion subtriangular with posterior end rounded and sides a little incurved; a shallow depression or furrow just in front of caudal end, this depression not extending forward to the middle. Ventral plates smooth, with paired sulci impressed only across anterior border. Last ventral plate only a little narrowed caudad; caudal margin widely incurved.

Coxopleura conspicuously produced caudad and terminating in three spines; two lateral spines and none on dorsal surface. First eleven pairs of legs with two tarsal spines; the others, to and including the twentieth, with one tarsal spine. Femur of anal legs ventrally with an outer row of four spines and an inner row of two; inner sur-

<sup>1</sup> Named for Colonel Clifford C. Gregg, Director of Field Museum of Natural History.

face with a lower series of three spines and an upper one of two; a short spine at distal end.

Length 49 mm.

*Remarks.* In some features resembling *O. telus* Chamberlin of New Guinea but differing in having only the first eleven pairs of legs with two tarsal spines (instead of nineteen pairs of legs so armed) and also in having the last ventral plate scarcely narrowed caudad, much as in *O. nemorensis* Silvestri, which differs in having only the first four pairs of legs with two tarsal spines.

**Otostigmus samacus** sp. nov.

*Type* from Samac, Alta Verapaz, Guatemala. Male. Collected by Daniel Clark.

*Description.* Olivaceous, with head a darker olive than rest of dorsum and legs and antennae paler. Antennae composed of seventeen segments of which the first  $2\frac{1}{4}$  or  $2\frac{1}{2}$  are glabrous. Cephalic plate smooth, not punctate. Prosternal teeth 4 4 distinct and acute. Dorsal plates with paired sulci complete from the fourth caudad. Only the last dorsal plate distinctly marginal laterally. This last plate with caudal margin moderately produced and widely convex at middle; without median sulcus and only slightly depressed in an area caudad of middle. Dorsal plates smooth. All ventral plates without complete paired sulci. Each plate typically with a short median longitudinal impression in front of middle and one on caudal border; a short longitudinal impression is also present on each side near middle of length in the position occupied in some species by the paired sulcus. Last ventral plate strongly narrowed caudad with caudal margin between rounded corners nearly straight; surface with a median longitudinal furrow across caudal border.

Coxopleura without processes behind, the caudal border but slightly, bluntly extended toward inner corner; without spines. Legs of the first pair with two tarsal spines; the others, to and including the nineteenth, with a single tarsal spine; twentieth without tarsal spine. Anal legs wholly lacking spines; femur with a clavate process from near base on inner side extending caudad over somewhat more than two-thirds the length of the femur; caudal end of the latter set off by an encircling sulcus which is deepest below.

Length about 40 mm.

*Remarks.*— Resembling *O. scabricaudus* H. and S. of Brazil. It differs, e.g., in the processes of the femora of the anal legs, these



being attached farther from the base and being relatively shorter, with distal end rounded, not truncate, and the spot of golden hair dorsal rather than distal in position.

### **Ethmostigmus platycephalus** Newport

*Heterostoma platycephala* Newport, Trans. Linn. Soc. Lond., 19, p. 415, 1845.

*Ethmostigmus platycephalus* Kraepelin, Rev. Scolopendriden, p. 162, 1903.

Dutch New Guinea: Manokwari, June 1, 1929, 1 (K. P. Schmidt).

### **Ethmostigmus trigonopodus** Leach

*Scolopendra trigonopoda* Leach, Zool. Misc., 3, p. 36, 1817.

Kenya Colony: 1, April, 1906 (Edmund Heller).

French Equatorial Africa: Fort Archambault, 1 (F. Lester Fagle).

## **Family Scolopendridae**

### **Cupipes andinus** Kraepelin

*Cupipes andinus* Kraepelin, Rev. Scolopendriden, p. 182, fig. 122, 1903.

Peru: Hacienda Urco, 9,500 feet, near Calca, Cuzco, 3, September 15 and 22, 1939 (J. M. Schmidt).

### **Cupipes guildingi** Newport

*Scolopendra guildingi* Gervais, Ins. Apt., 4, p. 284, 1847.

Haiti: Kenskoff, 7,500 feet, under stones, 8, December 2, 1928; Diquini Cave, west of Port au Prince, 1, December 7, 1929 (K. P. Schmidt).

### **Trachycormocephalus mirabilis** Porath

*Cormocephalus mirabilis* Porath, Bih., Svensk. Vetensk.-Akad. Handl., 4, p. 18, 1876.

*Trachycormocephalus mirabilis* Kraepelin, Rev. Scolopendriden, p. 219, 1903.

Iraq: Baghdad, 25, 1934-39 (Henry Field, R. A. Martin, W. R. Kennedy and Yusuf Lazar); Nasiriyah, 55, March 12 24, 1935 (Yusuf Lazar).

Iran: Rayy, 1, September 9, 1934 (Henry Field and R. A. Martin).

### **Hemiscolopendra punctiventris** Newport

*Scolopendra punctiventris* Newport, Ann. Mag. Nat. Hist., (1), 13, p. 100, 1844.

*Scolopendra woodi* Meinert, Proc. Amer. Phil. Soc., 23, p. 199, 1886.

*Hemiscolopendra punctiventris* Kraepelin, Rev. Scolopendriden, p. 217, 1903.

Florida: Punta Gorda, 18, March-May, 1941 (Henry Ramstadt).

### **Scolopendra polymorpha Wood**

*Scolopendra polymorpha* Wood, Proc. Acad. Nat. Sci. Phila., 1861, p. 41, 1861.

Kansas: Arkalon, May 9, 1904, 1.

California: Bolton's Ranch, Riverside County, 1, August 12, 1932 (Ben Cascard); Los Angeles, 44, 1935-39, 1, April 19, 1936 (Gordon Grant).

Arizona: Gila County, Tonto National Monument, 2,300 feet, 2, April 27, 1937 (K. P. Schmidt).

Mexico: Puebla, Tehuacán, 5,200 feet, July 7, 1941 (H. S. Dybas).

### **Scolopendra morsitans Linnaeus**

*Scolopendra morsitans* Linnaeus, Syst. Nat., 10th ed., p. 638, 1758.

India: Katchgarh, United Provinces, 3 (R. L. Fleming).

French Oceania: Makatea, northeast of Tahiti, 1, February 14, 1929 (K. P. Schmidt).

Cook Islands: Aitutaki Island, 1, 1930 (Chancellor Expedition).

### **Scolopendra viridis Say**

*Scolopendra viridis* Say, Proc. Acad. Nat. Sci. Phila., 1821, p. 110, 1821.

Mexico: Paso del Rio, Colima, 2, July, 1903 (Dr. E. Merich); Lago de Chaleco, 1, 1901 (F. E. Lutz).

Florida: Gottfried Creek Bridge, Englewood, Polk County, 1, February 24, 1939 (A. C. Weed); Ormond Beach, Volusia County, 2, March 20, 1934 (Edward Brundage).

Louisiana: Indian mound, East Baton Rouge Parish, 1, August 3 7, 1923; one mile from mouth of Tangipahoa River, 1, July 21, 1923 (A. C. Weed).

Arkansas: Mount Magazine, Logan County, 2,500 feet, 1, March 24, 1938 (K. P. Schmidt).

Illinois: Alto Pass, Union County, 1, April 21, 1928 (Bryan Patterson).

Texas: San Marcos (at Ezell's Cave), Hays County, 1, April 6, 1937; 5, April 22, 1941 (K. P. Schmidt); Chisos Mountains, Brewster

County, 4, July 31- August 10, 1937 (K. P. Schmidt); Mount Locke, Jeff Davis County, 5,800 feet, 1, April 13, 1937 (K. P. Schmidt).

Georgia: Thomasville, 1, April, 1940 (Henry Field).

Mexico: Vera Cruz, Las Vigas, 5,500 feet, 1, June 30, 1941 (H. S. Dybas).

Nuevo León: Ciénaga de Flores, 1, June 14, 1941 (H. S. Dybas).

### ***Scolopendra alternans* Leach**

*Scolopendra alternans* Leach, Trans. Linn. Soc. Lond., 11, p. 383, 1815.

Florida: Miami, Dade County, 2, July, 1918 (W. I. Clarksworth).

Haiti: Christophe's Citadel, Cape Haitien, 2,800 feet, 1, December, 1928 (K. P. Schmidt).

### ***Scolopendra subspinipes* Leach**

*Scolopendra subspinipes* Leach, Trans. Linn. Soc. Lond., 11, p. 383, 1815.

China: Baurong, Szechwan, 4 (three young), May 7, 1929 (Herbert Stevens); Kiating, 2, May 15, 1932 (F. T. Smith).

Indo-China: Banmethuot, Annam, 400 meters, 1, March 18, 1937 (W. H. Osgood).

Marquesas Islands: Taohuku, Hiva-Oa, 1, February 6, 1929 (K. P. Schmidt).

Territory of Hawaii: Honolulu, 1 (F. T. Smith); two miles southwest of Honolulu, 5, December 11, 1920 (S. V. H. Jones).

### ***Scolopendra metuenda* Pocock**

*Scolopendra metuenda* Pocock, Ann. Mag. Nat. Hist., (6), 16, p. 423, 1895.

Solomon Islands: Webster Cove, Kulambangra, 2 (K. P. Schmidt).

### ***Scolopendra galapagoensis* Bollman**

*Scolopendra galapagoensis* Bollman, Proc. U. S. Nat. Mus., 13, p. 216, 1889.

Galapagos Islands: Indefatigable Island, 4, January 12, 1929, in "green zone, about 800 feet altitude, under stones" (K. P. Schmidt).

British Guiana: Demerara, 1, March, 1922 (B. E. Dahlgren).

### ***Scolopendra cingulata* Latreille**

*Scolopendra cingulata* Latreille, in Cuvier, Reg. Anim., 2nd ed., 6, p. 339, 1829.

Syria: "T-3-Station," 2 (Henry Field and R. A. Martin).

Iraq: Tal Afar area, west of Mosul, 1, lacking anal legs but probably this species (Henry Field and R. A. Martin).

Transjordan: Mafraq, 1 (F. R. S. Shaw).

Palestine: Afule, 1 (F. R. S. Shaw).

### ***Scolopendra valida* Lucas**

*Scolopendra valida* Lucas, in Hist. Nat. Iles Canariens, Ent., p. 49, 1839.

Arabia: Mecca, 2 (H. St. J. Philby); Shabiwa, Hadvamaut, 1, 1933; Aden, 1 (A. R. M. Rickards).

Iraq: Tal Afar area west of Mosul, 1 (Henry Field and R. A. Martin).

### ***Scolopendra heros* Girard**

*Scolopendra heros* Girard, in Marcy's Rept. Exped. Red River, p. 272, pl. 18, 1854.

Texas: San Marcos, Hays County, April 23, 1941 (J. Schmidt); Chisos Mountains, Brewster County, 5,400 feet, 1, August 1, 1937 (K. P. Schmidt); Mount Locke, Jeff Davis County, 6,800 feet, 1 (K. P. Schmidt).

Arkansas: Hollis, Perry County, 1, May 25, 1938 (K. P. Schmidt).

## **Order Geophilida**

### **Family Himantariidae**

#### ***Bothriogaster egyptiaca* Attems**

*Bothriogaster egyptiacus* Attems, Mitt. Mus. Hamburg, 13, p. 25, 1896.

Iraq: Nasiriya, 1, March 12 24, 1935 (Yusuf Lazar).

#### ***Gosiphilus laticeps* Wood**

*Strigamia laticeps* Wood, Journ. Acad. Nat. Sci. Phila., (2), 5, p. 49, 1862.

*Gosiphilus laticeps* Chamberlin, Pomona Journ. Zool. Ent., 4, p. 672, 1912.

Texas: San Marcos, 1, April 22, 1941 (K. P. Schmidt).

#### ***Gosiphilus orizabae* sp. nov.**

*Type* from Orizaba, Vera Cruz, Mexico. Altitude 4,000 feet. A male. Collected July 9, 1941, by H. S. Dybas.

*Allotype*, a female, taken with the type.

*Description*.— Close to *G. laticeps* Wood of the southwestern United States, but differing in the more linear area of the ventral

pores, an area also less sharply defined. The legs seem also to be more numerous than in *laticeps*, 91-95 pairs, as against a most frequent number of about 81.

Length of holotype about 40 mm.

### **Gosiphilus craterus** sp. nov.

*Type* from five miles north of Jacala, Hidalgo, Mexico. Altitude 5,000 feet. A female. Collected June 27, 1941, by H. S. Dybas.

*Description*.—The holotype is a robust individual narrowing from the middle region toward each end and less ribbon-like than other species from which it is set apart by the number of pairs of legs, namely 135. Head small and proportionately broad, with the flattened antennae attenuated distally as usual. The ventral pores are in a sharply limited, narrowly oblong, transverse area. Last ventral plate of usual broad proportions, the caudal margin decidedly incurved.

Length of holotype about 65 mm.

### **Garriscaphus amplus** Chamberlin

*Garriscaphus amplus* Chamberlin, Ann. Ent. Soc. Amer., 34, p. 790, 1941.

California: Los Angeles (Elysian Park), 1, April 17, 1938 (Gordon Grant).

Previously known from a single specimen, the holotype, taken two miles west of Kerrville, California. The Los Angeles specimen has 145 pairs of legs as against 155 pairs in the holotype, a not unusual degree of variation in the group, but seems to agree fully in all ordinary structural features. It is about 150 mm. in length.

## **Family Schendylidae**

### **Schendyla nemorensis** Koch

*Geophilus nemorensis* Koch, Deutschlands Crust., Myr., Arachn., fasc. 9, pl. 4, 1836.

*Schendyla nemorensis* Bergsøe and Meinert, Naturh. Tidsskr., (3), 4, p. 105, 1866.

Illinois: Chicago Ridge, Cook County, 1, September 27, 1921 (A. C. Weed).

### **Nyctunguis heathi** Chamberlin

*Pectiniunguis heathi* Chamberlin, Ann. Ent. Soc. Amer., 2, p. 176, 1909.

*Nyctunguis hathi* Chamberlin, Bull. Mus. Comp. Zool., 58, p. 201, 1914.

California: Los Angeles, 1, December 22, 1936 (Gordon Grant).

***Pectiniunguis fieldi*<sup>1</sup> sp. nov. Pl. 13, figs. 1, 2.**

*Type* from Rio Paranay, Misiones, Argentina. Collected September 20, 1926, by K. P. Schmidt.

*Description.*—In the poorly preserved holotype the head and anterior segments and the posterior segments are somewhat orange in color, the intervening segments appearing much darker and apparently in life with a median longitudinal pale line dividing the broad dark area. Head longer than wide with the sides moderately convex from end to end and anterior margin very obtusely angular. Prebasal plate exposed. Median arch of labrum wide and even, not deep, bearing thirteen stout teeth of which those of middle region are relatively blunt, those toward the sides more acute and forming a transition to the lateral pretinations, of which there are about four on each side. Mandible with dental plate divided into three blocks which bear 3+2+5 teeth. Apparently only one pair of lappets on first maxillae, these produced from coxal piece and not long. Claws of prehensors when closed about even with anterior margin of head. All segments of prehensors unarmed within.

Spiracles all circular, the first largest, others decreasing caudad as usual. Ventral pores in a circular area on each sternite from second to the antepenultimate. Pairs of legs 43.

Length about 28 mm.

*Remarks.* The number of pairs of legs in this species is smaller than in any previously described form. The dentition of the pieces of the dental plate on the mandible seems to be distinctive, as also is the absence of distal lappets on the palpus of the first maxillae.

**Family Mecistocephalidae**

***Mecistocephalus consocius* sp. nov. Pl. 13, fig. 3.**

*Type* from Hog Harbor, Espiritu Santo Island, New Hebrides. Collected in 1929 by K. P. Schmidt. In vial with *Kalotermes* (*Neotermes*) *sanctaerucis* Snyder.

*Description.*—General color yellowish, unmarked, with head and prehensors light chestnut. Cephalic plate longer than greatest

<sup>1</sup> Named for Mr. Marshall Field III, patron of Field Museum. The species was collected in the course of the Marshall Field Brazilian Expedition.

width in ratio of 55:33; widest at frontal suture whence it gently narrows to the more abruptly narrowed caudal fourth, the shape nearly as in *M. cygethus* Chamberlin. Areolated area of clypeus longer than the posterior non-areolated bands.

Labrum with lateral pieces shaped much as in *M. vanheurni*, but lateral ends even more narrowed; median piece comparatively large, more slightly narrowed than in *vanheurni* to the end portion which is abruptly narrowed to an obtuse angle, the extreme apex of which is truncate in one specimen. The free end of the median piece is on a level with the caudal margin of the lateral pieces or slightly exceeds it (fig. 3).

Prosternum with anterior margin bearing two pale low tubercles which are not truly dentiform. Femoroid of prehensors with the usual two teeth of which the more distal is much the larger and distally rounded or blunt. First segment beyond femoroid lacking a tooth or with the merest vestige of one. Next segment with a small, distally blunt tooth. Claw with low, very obtuse tubercle or denticle at base. Impression on sternites a simple longitudinal sulcus not furcate anteriorly.

The type lacks the posterior end of the body; but a young specimen of the species has 49 pairs of legs. A species apparently of small or moderate size.

*Remarks.*—The species may be readily distinguished by form of sternal impressions together with characters of the armature of prehensorial feet and the details of labrum.

***Mecistocephalus manokwarius* sp. nov.** Pl. 13, figs. 4, 5.

*Type* from Manokwari, Dutch New Guinea. Collected June 1, 1929, by K. P. Schmidt.

*Description.* General color brown without markings. Head, basal plate and prehensors chestnut. Cephalic plate longer than wide (58:35), of uniform width from frontal suture to about beginning of the posterior fourth over which the sides converge strongly to a relatively narrow caudal end; anterior margin scarcely, obtusely excised between bases of antennae (see fig. 4). Labrum with median piece rather strongly narrowed from anterior end to middle and these of uniform width to the rounded caudal end which is exceeded by the adjacent angles of the lateral pieces. Caudal margin of each lateral piece running in a nearly straight oblique line from near outer end to the acute caudo-mesal angle (see fig. 5). Mandible with seven lamellae; first lamella bearing eight teeth; mesal angle below

this lamella produced into an acute translucent process, wholly lacking marginal serrations. Anterior areolated area of clypeus a little shorter in the antero-posterior direction than the two posterior non-areolated bands taken together.

Prosternum with anterior margin bearing two small acute teeth. Femoroid of prehensors with two acute teeth of which the one at distal end is somewhat shorter; each of the following articles with a single tooth similar in size and form to the proximal one of the femoroid; claw with a small tubercle-like low tooth at base. Impression of sternites anteriorly furcate, branches short, with the angle formed by them slightly obtuse. Last ventral plate short, strongly narrowed caudad to an angle. Pores of coxopleura small and very numerous, covering entire surface both above and below. Pairs of legs, 49.

Length about 44 mm.

***Mecistocephalus tsenapus* sp. nov.** Pl. 13, figs. 6, 7.

*Type* from Tsenap Hills, upper Sepik River, Territory of New Guinea. Collected May 17, 1929, by K. P. Schmidt.

*Description*.—Dorsum light brown over most of length with a broad dusky band geminate by a pale median line. Head and prehensors dusky or blackish over a light chestnut background. Cephalic plate widest at frontal suture, thence conspicuously narrowed caudad to posterior fourth which is then more abruptly narrowed as usual (more strongly narrowed than in *M. consocius*); longer than wide (15:9) (fig. 6). Areolated area of clypeus longer than posterior non-areolated band. Median piece of labrum moderately narrowed caudad; caudal end very obtusely angled with a single denticle at angle, extending beyond caudal margin of lateral pieces. Caudal margins of lateral pieces smooth, nearly transverse, with lateral ends bent somewhat caudad of mesal parts (fig. 7).

Anterior margin of prosternum with two low, pale tubercles, one each side of median incision. Femoroid of prehensors with a rounded tooth at distal end, none proximally, but vestigial at end of coxoid division. Second segment without tooth; the third with a small tooth, and the claw with the usual low tubercle at base. Impression of sternites long, sharply impressed, not furcate, or faint, acutely meeting branches sometimes detectable. Last sternite small, trapeziform. Coxopleural pores absent from mesal and caudal borders. Pairs of legs, 49.

Length about 16 mm.



***Dasyptyx hebrides* sp. nov.** Pl. 14, figs. 8, 9.

*Type* from Hog Harbor, Espiritu Santo Island, New Hebrides. Collected April 5, 1929, by K. P. Schmidt.

*Description.*—Dorsum brownish, covered with a fine network of dusky lines and spots which also cover the sides; a median dorsal pale line. Head and prehensors chestnut. Head longer than wide (105:65); widest at anterior end, thence narrowing obviously to about beginning of caudal fourth where the sides round in, and the narrowing becomes more abrupt; caudal margin very slightly arcuate (fig. 8). Median piece of labrum narrow behind, widest anteriorly, the caudal end on a level with the mesal ends much as in *Dasyptyx pseustes* but with lateral ends farther forward (see fig. 9). Mandible with sixteen lamellae of usual general form, with no projecting angle below the first of these.

Prosternum with two rounded teeth on anterior margin. Femoroid with two teeth of which the distal is much larger and conical in shape. Next segment with tooth minute or absent and the succeeding one with a larger but still very small tooth. Claw with the usual low angle or prominence at base. Impression of sternites furcate, the branches curving apart in an obtuse angle, the outer ends nearly transverse in position. Last ventral plate long trapeziform. Pores of coxopleura small and very numerous, the porous area not quite reaching caudal end and pores absent from narrow band along free mesal edge of the joint. Pairs of legs, 49.

Length about 62 mm.

## Family Oryidae

***Orphnaeus brevilabiatus* Newport**

*Geophilus brevilabiatus* Newport, Trans. Linn. Soc. Lond., 19, p. 436, 1845.

*Orphnaeus lividus* Meinert, Naturh. Tidsskr., (3), 7, p. 19, 1870.

*Orphnaeus brevilabiatus* Haase, Abh. Mus. Dresden, 5, p. 111, pl. 6, 1887.

Guatemala: Escobas (opp. Puerto Barrios), 1, April 18, 1934 (K. P. Schmidt).

New Guinea: Wogamus, upper Sepik, 1, May 18, 1929 (K. P. Schmidt).

***Notiphilides maximiliani* Humbert and Saussure**

*Notiphilus maximiliani* Humbert and Saussure, Rev. Mag. Zool., (2), 22, p. 205, 1870.

*Notiphilus maximiliani* Saussure and Humbert, Miss. Sci. Mex., Myriop., pt. 611, p. 141, pl. 7, fig. 22, 1872.

Guatemala: Escobas, Izabal, 1, November 29, 1933, "in rotten stump" (F. J. W. Schmidt).

British Honduras: Silk grass, 2, May 10 and November 17, 1939, "center of rotten log"; Bokowina, 1, October 24, 1939, "in damp, rotten log" (I. T. Sanderson).

### Family Geophilidae

#### ***Geophilus regnans* Chamberlin**

*Geophilus regnans* Chamberlin, Proc. Acad. Nat. Sci. Phila., 56, p. 654, 1904.

California: Los Angeles, 18, 1936-39 (Gordon Grant).

#### ***Geophilus rubens* Say**

*Geophilus rubens* Say, Journ. Acad. Nat. Sci. Phila., 2, p. 113, 1821.

Wisconsin: Delavan, Walworth County, 2, August, 1940 (H. S. Dybas); Antigo, Langlade County, 1 (R. Raddatz).

Arkansas: Near base of Rich Mountain, Polk County, 2,000 feet, 1, March 23, 1938 (K. P. Schmidt).

Illinois: Aurora, Kane County, 1, April, 1940 (H. S. Dybas); Glenview, Cook County, 1, October 12, 1940 (W. J. Beecher); Monee, Will County, 2, March 24, 1908 (Henry Ramstadt); Cook County, 2, October 19, 1941 (H. S. Dybas); Plano, Kendall County, 1, May 3, 1942 (H. S. Dybas).

Indiana: Dune Acres, Porter County, 1, March 22, 1942 (H. S. Dybas); Tremont, Porter County, 1, May 31, 1942 (H. S. Dybas).

Texas: Chisos Mountains, Brewster County, 1, August 1-10, 1937, a variant with 59 pairs of legs and lacking the geminate dark stripe (K. P. Schmidt).

#### ***Geophilus mordax* Meinert**

*Geophilus mordax* Meinert, Proc. Amer. Phil. Soc., 23, p. 207, 1886.

Tennessee: Great Smoky Mountains National Park, Gatlinburg, 7, June 13, 1941; Greenbrier Cove, 1, June 15, 1942; Blount County, Townsend, June 16, 1942, 1 female with numerous young (H. S. Dybas).

#### ***Geophilus longicornis* Leach**

*Geophilus longicornis* Leach, Trans. Linn. Soc. Lond., 11, p. 386, 1815.

England: 2, October 23, 1936 (Henry Field).

***Arenophilus watsingus* Chamberlin**

*Arenophilus watsingus* Chamberlin, Bull. Mus. Comp. Zool., 54, p. 418, 1912.

Missouri: Libertyville, St. Francois County, 1, April 2, 1937 (K. P. Schmidt).

Arkansas: Eleven miles west of Hot Springs, Garland County, 1, March 21, 1938 (K. P. Schmidt). This specimen represents a varietal form much larger than any previously known.

***Arenophilus bipuncticeps* Wood**

*Geophilus bipuncticeps* Wood, Journ. Acad. Nat. Sci. Phila., (2), 5, p. 45, 1862.

*Arenophilus bipuncticeps* Chamberlin, Can. Ent., 44, p. 66, 1912.

Illinois: Chicago, Jackson Park, 1, 1897 (E. B. Chope); Monee, Will County, 1, March 24, 1908 (Henry Ramstadt); Plano, Kendall County, 1, May 3, 1942 (H. S. Dybas); Willow Springs, Cook County, 1 (H. S. Dybas).

Arkansas: Nineteen miles south of Pocahontas, Randolph County, 1, April 14, 1941 (J. M. Schmidt).

Florida: Punta Gorda, 1, March, 1941 (Henry Ramstadt).

***Arenophilus unaster* Chamberlin**

*Geophilus attenuatus unaster* Chamberlin, Ann. Ent. Soc. Amer., 2, p. 179, 1919.

*Arenophilus unaster* Chamberlin, Bull. Mus. Comp. Zool., 54, p. 417, 1912.

Texas: San Marcos, Hays County, 1, April 22, 1941 (K. P. Schmidt).

***Arenophilus iugans* sp. nov. Pl. 14, fig. 10.**

*Type* from Los Angeles, California. Collected December 22, 1936, by Gordon Grant.

*Paratype*.—A specimen from Los Angeles collected March 1, 1936, by Gordon Grant.

*Description*.—Yellow, with head and prehensors but little darker. Head subquadrate in general outline, with sides moderately bowed out from end to end; caudal margin wide, scarcely incurved; anterior margin a little obtuse between corners, with an obtuse notch at middle. No frontal suture evident.

Prehensors with a minute tooth on base of claw, otherwise unarmed, the femoroid lacking the rounded, nodular tooth present in *bipuncticeps*. Spiracles all circular, the first largest, the second abruptly smaller, the others decreasing very gradually. Sternites

with a median longitudinal furrow which is deep over middle region but weak or absent over anterior and posterior portions. Ventral pores in a transverse band across caudal portion of plate somewhat as in *A. bipuncticeps*. Last ventral plate broad, trapeziform. Coxopleural pores large, two on each side, partly covered by the sternite. Second tarsal segment of anal legs slender, with the terminal appendage long and especially slender, relatively much longer than in *A. bipuncticeps* (fig. 10). Pairs of legs, 57.

Length about 22 mm.

### **Garrina parapodus** Chamberlin

*Simoleptus parapodus* Chamberlin, Ann. Ent. Soc. Amer., 34, p. 777, 1941.

Missouri: Libertyville, St. Francois County, 1, April 2, 1937 (K. P. Schmidt).

Previously known only from Bangs, Texas.

### **Garrina tecpanus** sp. nov. Pl. 14, fig. 11.

*Type* from Santa Elena, near Tecpan, Chimaltenango, Guatemala. Altitude 9,500 feet. Collected February 7, 1934, by K. P. Schmidt.

*Paratypes*. Two from Volcan Tajumulco, collected February 13 and 22, 1934, by K. P. Schmidt. One of these is a female with numerous young.

*Description*. Body yellow throughout, with head and prehensors not darker than dorsum of body. Head broader than long (29:26), shorter than in *parapodus* and broader anteriorly with lateral margins convex. Frontal suture absent or obscure. Prebasal plate exposed (fig. 11). Prehensors when closed not exceeding the anterior margin of the head; neither prosternum nor segments armed. Chitinous lines distinct and complete. Tergites bisulcate. Spiracles small and strictly circular, the anterior ones not vertically elliptic as in *parapodus*. Ventral plates not sulcate, smooth. Ventral pores apparently confined to a narrow transverse band on posterior border. Last ventral plate wide, covering the coxal pores, which are large and two in number on each side. Anal legs with last tarsal joint abruptly narrowing as in the genotype. Pairs of legs, 59.

Length about 32 mm.

### **Dysmesus** gen. nov.

Distinguished from *Brachygeophilus* and other American genera of Geophilidae in having the coxosternum of the second maxillae pre-

serving a distinct median suture. Claw of the second maxillae simple, thus differing from the Tasmanian *Pachymerellus*. Coxae of first maxillae with long external lappet. Median part of labrum with stout teeth at middle, weaker ones laterally; lateral parts pectinate. Prehensors weak, covered from above. Ventral pores absent.

Genotype *Dysmesus orites* sp. nov.

### ***Dysmesus orites* sp. nov.**

*Type* from Greenbrier Cove, Great Smoky Mountains National Park, Tennessee. Collected June 14 19, 1942 (H. S. Dybas).

*Paratype*.—Collected with type.

*Description*.—Cephalic plate short, wider behind middle where fully as wide as long; caudal margin straight and wide; no frontal suture present. Prebasal plate not exposed. Prehensors small, covered from above, the closed claws falling short of the anterior margin of head. Claws slender, armed at base with a minute denticle, the other joints unarmed. Chitinous lines not evident. Spiracles all circular. No ventral pores evident. Last ventral plate moderately wide, wider than long, sides straight and nearly parallel and caudal margin straight. Coxal pores small, few in number, about six on each side. Anal legs ending in well-developed claws. Pairs of legs, 45–51.

Length about 14–15 mm.

## **Family Linotaeniidae**

### ***Linotaenia fulva* Sager**

*Strigamia fulva* Sager, Proc. Acad. Nat. Sci. Phila., 8, p. 109, 1856.

*Scolopanes bothriopus* Meinert, Proc. Amer. Phil. Soc., 23, p. 222, 1885.

*Linotaenia fulva* Bollman, Proc. U. S. Nat. Mus., 11, p. 341, 1888.

Illinois: River Forest (Thatcher's Woods), Cook County, 1, November 2, 1922 (A. C. Weed); Monee, Will County, 1, March 22, 1908 (Henry Ramstadt).

Louisiana: Creston, Natchitoches Parish, 1, April 6, 1915 (K. P. Schmidt).

### ***Linotaenia chionophila* Wood**

*Strigamia chionophila* Wood, Journ. Acad. Nat. Sci. Phila., (2), 5, p. 50, 1862.

Indiana: Porter County, Tremont, 1, October 26, 1941 (Rupert Wenzel).

Family **Chilenophilidae****Arctogeophilus umbraticus** McNeill

*Microcephalus umbraticus* McNeill, Proc. U. S. Nat. Mus., 10, p. 332, 1887.

*Gnathomerum americanum* Ribaut, Bull. Soc. Hist. Nat. Toulouse, 43, p. 120, 1910.

*Gnathomerum umbraticum* Chamberlin, Bull. Mus. Comp. Zool., 54, p. 422, 1912.

Tennessee: Great Smoky Mountains National Park, Greenbrier Cove, 5, May 14 19, 1942 (H. S. Dybas).

**Taiyuna occidentalis** Meinert

*Geophilus occidentalis* Meinert, Proc. Amer. Phil. Soc., 23, p. 220, 1885.

*Taiyuna occidentalis* Chamberlin, Pomona Journ. Zool. Ent., 4, p. 661, 1912.

California: Los Angeles, 2, April 5, 1936 (Gordon Grant).

**Suturodes gerhardi**<sup>1</sup> sp. nov. Pl. 14, fig. 12.

*Type* from Volcan Tajumulco, San Marcos, Guatemala. Collected February 21, 1934, by K. P. Schmidt.

*Description.* In this form the head is much longer than wide with the sides parallel between the rounded corners. It differs from *schmidtii* and *guatemalae* in having the frontal suture distinct. Cephalic plate much overlapping the basal, the exposed portion of which, in consequence, is short. Anterior margin of prosternum with two small low conical teeth or tubercles. Claws of prehensors when closed extending beyond end of first antennal segment. Femoroid of prehensors armed within at distal end with a small, black, conical tooth and the claw similarly curved at base; intervening segments unarmed. Anterior spiracles large, vertically elliptic, the first larger than second which is intermediate, the other decreasing in size caudad. Last tergite longer and proportionately narrower than in *schmidtii*. Coxal pores small and numerous, present also dorsally along the tergite (fig. 12). Pairs of legs, 79.

Length about 35 mm.

**Suturodes schmidtii** sp. nov. Pl. 14, fig. 13.

*Type* from Volcan Tajumulco, San Marcos, Guatemala. In bromeliad, alt. 7,000-9,000 feet. Collected February 16, 1934, by K. P. Schmidt.

<sup>1</sup> Named for Mr. William J. Gerhard, Curator of Insects, Field Museum.

*Description.*—A species apparently nearest to *S. guatemalae* Chamberlin. It is like that species in lacking a frontal suture on the cephalic plate, but differs in having the sides of the plate essentially parallel over the middle region instead of distinctly converging caudad. It differs as well in having the teeth of the prosternal margin slender and acute instead of small and nodular; teeth of femoroid small and pale, instead of larger, more robust and black. It differs obviously also in having all spiracles circular instead of the first vertically elliptic. It agrees with *guatemalae* in the rounded shield-shaped form of the last tergite (fig. 13). Pairs of legs, 47.

Length about 30 mm.

### ***Polycricus paucipes* Chamberlin**

*Lestophilus paucipes* Chamberlin, Bull. Mus. Comp. Zool., 59, p. 523, 1915.

Mexico: Vera Cruz, El Fortin, 8, July 5 and 9, 1941 (H. S. Dybas).

### ***Polycricus cruzanus* sp. nov. Pl. 16, fig. 19.**

*Type* from Las Vigas, Vera Cruz, Mexico. Collected June 30, 1941, by Henry S. Dybas.

*Paratypes.*—Three specimens taken with the type.

*Description.*—Having the general structure of *L. paucipes*, the genotype, but at once to be distinguished by the last tergite, which is broad posteriorly, subquadrate in outline as shown in fig. 19. The number of pairs of legs most frequently 47, three out of four specimens having this number, the fourth 45.

Length to about 30 mm.

### ***Polycricus jacalanus* sp. nov. Pl. 16, fig. 20.**

*Type* specimen taken five miles north of Jacala, Hidalgo, Mexico. Altitude 5,000 feet. Collected June 24, 1941, by Henry S. Dybas.

*Description.*—Suggesting *P. cruzanus* in the broad last tergite, but this is proportionately longer and more narrowed and rounded behind as shown in fig. 20. Pairs of legs, 47.

Length about 20 mm.

### ***Polycricus verus* sp. nov. Pl. 16, fig. 21.**

*Type* from Tezonapa, Vera Cruz, Mexico. Collected August 3, 1941, by Henry S. Dybas.

*Paratype.* One specimen, taken with the type.

*Description.* Agreeing in general structure with *L. cruzanus*, but apparently a somewhat larger form most readily distinguished by the larger number of pairs of legs (57-59) and the different form of the last tergite as shown in fig. 21.

Length 37 mm.

***Polycricus brachycephus* sp. nov.** Pl. 16, fig. 22.

*Type* from Tezonapa, Vera Cruz, Mexico. Collected August 8, 1941, by Henry S. Dybas.

*Paratype.* One specimen taken with the type.

*Description.* Characterized by the form of the cephalic plate which is proportionately shorter than, e.g., in *L. verus*, and relatively broader anteriorly than usual for species of the genus, as shown in fig. 22. No frontal suture evident. It is also distinct from all other known species in the complete absence of teeth on the prosternal margin. Form of the last tergite shown in fig. 22.

Length about 20 mm.

***Peruphilus* gen. nov.**

Agreeing in general with the Mexican *Polycricus* but with anal legs bearing a well-developed claw.

Genotype *Peruphilus sanborni* sp. nov.

***Peruphilus sanborni* sp. nov.**

*Type* from Chosica, Rimac Valley, Peru. Altitude 2,821 feet. A female, collected by C. C. Sanborn.

*Description.* Cephalic plate longer than wide as in species of *Polycricus*, the sides between corners nearly straight and parallel; overlapping widely the basal plate. Labrum with median piece of good size, bearing a series of stout teeth. Lappets of first maxillae shorter than usual in *Polycricus*. Second maxillae with coxae narrowly united at middle; joints of palpus without processes, its claw simple; pleurosternal suture very fine. Claws of prehensors when closed attaining distal end of first antennal article. Prehensors armed as in species of *Polycricus*; teeth of prosternum small and pale. All spiracles circular, the first largest, the others decreasing from the second caudad. Ventral pores in a transverse band in front of caudal margin. Anterior sternites with anterior pocket limited below by a chitinous rim, the preceding sternite projecting



into the pocket. Last ventral plate narrow, the sides converging caudad. Coxopleural pores small and numerous. In female, anal legs of moderate length, slender, with a well-developed claw. Pairs of legs, 43.

Length about 15 mm.

### Family Sogonidae

#### *Gospina dybasi* sp. nov. Pl. 17, fig. 24.

*Type* from five miles north of Jacala, Hidalgo, Mexico. Altitude 5,000 feet. A female. Collected June 24, 1941, by Henry S. Dybas.

*Description*.—Head small, short, subquadrate, with anterior margin rounded, the posterior wide and straight and the lateral moderately convex; without trace of front suture; overlapping the basal plate. First maxillae bearing rather short lappets on external side. Claw of palpus of second maxillae entire and smooth; coxae completely fused together at middle. Labrum forming a large transverse piece which is armed along caudal border, excepting at ends, with pectiniform teeth much as in *Sogona*. Prehensors short, all joints unarmed, the claws when closed a little short of anterior margin of head. Prosternum with chitinous lines complete. Dorsal plates bisulcate. Spiracles all circular. Anterior ventral plates with middle of anterior margin forming a more sclerotized rim. Last ventral plate broad, trapeziform. Coxal pits two on each side. Anal legs very long and slender, terminating in a small process in place of claw as shown in fig. 24. Pairs of legs, 55.

Length about 15 mm.

### Order Lithobiida

#### Family Ilenicopidae

#### *Lamycetes cuzcotes* sp. nov.

*Type* from Hacienda Urco, near Calca, Cuzco, Peru. Taken "in quebrada, 10,000 ft., under stones." Male. Collected September 18, 1939, by Karl P. Schmidt.

*Paratype*.—A single male, collected with the type.

*Description*.—Dorsum dark brown with caudal borders of tergites darkest. Legs a lighter brown, and the antennae orange-colored. Head dusky in a median area and over lateral borders. Body conspicuously attenuated caudad, less attenuated cephalad. Antennae

short, composed of 30-32 segments. Prosternal teeth small and pale, 2+2, each pair toward median line. Median sinus very small, V-shaped. Posterior angles of ninth and eleventh dorsal plates moderately produced, in this respect contrasting with *diffusus*, *pinampus*, *fulvicornis*, etc. Coxal pores small, 1, 1, 1 to 1, 2, 2, 2 in number.

Gonopods of male extending nearly directly caudad; composed of three segments and a terminal pale, straight and spine-like claw without basal spines. Both specimens have lost their anal legs.

Length 10 mm.

**Lamyctes leon** sp. nov. Pl. 17, fig. 23.

*Type* from Ciénega de Flores, Nuevo León, Mexico. A female. Collected June 19, 1941, by Henry S. Dybas.

*Allotype*. A male taken with the type.

*Description*. An obviously smaller species than *L. pinampus* of the southwestern United States. It suggests the latter form in the length and slenderness of the anal legs, the proportions of the joints of which are shown in fig. 23. It seems readily distinguishable in the characters of the antennae. These are composed of 26-27 segments instead of the 28 that are normal for *pinampus*, and beyond the second these are of nearly uniform size, not showing groups of two much shorter ones at intervals, as is characteristic of *pinampus*. The general color is yellow, but in both types the antennae proximally and the anal legs on fifth joint and part of adjacent joints are purplish.

Length 5-6.2 mm.

### Family Watobiidae

**Cruzobius viganus** sp. nov.

*Type* from Las Vigas, Vera Cruz, Mexico. A female. Collected June 30, 1941, by Henry S. Dybas.

*Allotype*.—A male taken with type.

*Paratype*.—A male taken with type and allotype.

*Description*.—A distinctly smaller form than *C. verus*, the genotype which was also from Vera Cruz, and also lighter in color, this being typically nearly yellow. It differs from *verus* in having the ocelli in two series and somewhat more numerous; e.g. 1+1, 3, or 1+1, 4, the upper ocellus enlarged. In *verus* a vestigial spot behind

eye series may represent the well-developed single ocellus in *viganus*. Antennae vary, segments twenty. The accessory claw of anal legs smaller, almost abortive. The anal legs of the male proportionately thicker than in *verus*. Claw of female genital forceps short and pale, trilobed but lobes weak. Basal spines 2 2, proportionately short.

Length 4.8 mm.

### Family Gosibiidae

#### **Gosibius paucidens** Wood

*Lithobius paucidens* Wood, Journ. Acad. Nat. Sci. Phila., (n.s.), 5, p. 14, 1862.

*Gosibius paucidens* Chamberlin, Can. Ent., 44, p. 204, 1912.

California: Los Angeles, 15, March April 19 (Gordon Grant).

#### **Gosibius (Abatobius) angelicus** sp. nov.

*Type* from Los Angeles, California. A male. Collected February 2, 1936, by Gordon Grant.

*Allotype*.—A female, same data as the type.

*Paratypes*.—Six, same data as the type.

*Description*.—Brown, with posterior borders of tergites typically darker; head and posterior segments and thin legs sometimes more or less of chestnut cast. Antennae short, composed of 20 22 segments. Ocelli, e.g., 1+4, 4, 3 with the single ocellus contiguous with posterior end of second series. Prosternal teeth 2+2 as usual. Posterior angles of none of the dorsal plates produced. Gonopods of female with claw entire and basal spines 2+2; mesal excavation in basal segment as usual. In the male, the tibia of the anal legs is longitudinally furrowed above, while in the penult legs it is longitudinally ridged above with ridge elevated at distal end. Ventral spines of anal legs, 0, 1, 3, 3, 1; dorsal, 1, 0, 3, 1, 0; claws 2. Ventral spines of penult legs, 0, 1, 3, 3, 2; dorsal, 1, 0, 3, 1, 1 or 1, 0, 3, 1, 0 (male); claws 3.

#### **Arenobius manegitus** Chamberlin

*Lithobius manegitus* Chamberlin, Ann. Ent. Soc. Amer., 4, p. 43, pl. 4, fig. 4, 1911.

*Arenobius manegitus* Chamberlin, Can. Ent., 44, p. 178, 1912.

Tennessee: Great Smoky Mountains National Park, Greenbrier Cove, 3, June 14–19, 1942 (H. S. Dybas).

**Guambius euthus** Chamberlin

*Lathobius euthus* Chamberlin, Proc. Acad. Nat. Sci. Phila., 1904, p. 652, 1904.

*Guambius euthus* Chamberlin, Bull. Mus. Comp. Zool., 57, p. 240, 1917.

Texas: San Marcos, Hays County, 2 (the adult has lost the posterior legs), April 22, 1941 (K. P. Schmidt).

The types of this species were from Austin, Texas.

**Labrobis minor** Chamberlin

Mexico: Vera Cruz, Las Vigas, 1 male, June 30, 1941 (H. S. Dybas).

**Vulcanbuis** Chamberlin

Distinguished from related gosibiid genera, e.g. *Labrobis*, in having both the anal and the penult legs conspicuously modified in the male. The fifth segment of the anal legs bears dorsally a conspicuous longitudinal ridge on crest. In the penult legs the fourth or fifth segment is swollen and has the dorsal surface more or less complanate and longitudinally furrowed.

Genotype *Vulcanbuis pedregalus* Chamberlin.

Includes also *Vulcanbuis cobulcanus* Chamberlin, *V. godmani* Pocock, *V. vulcani* Pocock and *V. salvini* Pocock.

**Vulcanbuis vulcani** Pocock

*Lathobius vulcani* Pocock, Biol. Centr.-Amer., Chilopoda and Diplopoda, p. 8, pl. 1, figs. 8 8b, 1895 Volcan Agua, Guatemala.

*Labrobis vulcani* Chamberlin, Bull. Mus. Comp. Zool., 59, p. 536, 1915.

Guatemala: Chichivac, near Tecpan, Chimaltenango, 1, February 1, 1934 (F. J. W. Schmidt).

**Vulcanbuis cobulcanus** Chamberlin

*Labrobis cobulcanus* Chamberlin, Proc. U. S. Nat. Mus., 60, art. 7, p. 10, pl. 1, figs. 6, 7, 1922.

Guatemala: Chichivac, near Tecpan, Chimaltenango, 2, February 1 7, 1934 (K. P. Schmidt and F. J. W. Schmidt).

The species was originally based on two females taken at Joyabaj, lower slope of Cobulco Mountain.

The present specimens have the antennae composed of from 34 to 42 segments. Ocelli arranged in three oblique series; e.g., 1+4, 4, 4; the single ocellus contiguous; top ocellus of caudo-dorsal series as large as the single ocellus. Prosternum agreeing in its charac-

teristic structure with types. Posterior angles of ninth, eleventh and thirteenth dorsal plates produced, those of the seventh a little convexly extended caudad. Coxal pores 3, 3, 3, 3, decreasing in size proximal in each series. Ventral spines of penult legs, 0, 1, 3, 3, 2 as in types. Ventral spines of anal legs, 0, 1, 3, 2, 1.

Length 14–15 mm.

### **Mayobius Chamberlin**

Differing from *Labrobius* and *Vulcanbius* in having the anal and penult legs of the male normal, wholly lacking special lobes or thickening.

Genotype *Mayobius alliacanus* Chamberlin.

### **Mayobius mandeli**<sup>1</sup> sp. nov.

*Type* from Chichivac, near Tecpan, Chimaltenango, Guatemala. A male. Collected February 4–7, 1934, by K. P. Schmidt.

*Paratypes*.—An additional male specimen and a female from the type locality, with the same data.

*Description*.—General color of dorsum brown, with head and posterior segments darker. Antennae composed of from 38 to 41+ articles, the tips of the antennae in the female holotype being broken off. Ocelli arranged in four series; e.g., 1+3, 3, 3, 2; single ocellus large, the caudal one of top series next in size and nearly as large as the single ocellus. Prosternal teeth 2+2 as usual; ectal spine setiform, borne on the slightly protruding outer angle of anterior margin. Posterior angles of seventh, ninth, eleventh and thirteenth dorsal plates produced as usual, the production of seventh weak, with inner side of angle long and very oblique. Coxal pores 5, 5, 5, 5. Ventral spines of anal legs, 0, 1, 3, 3, 1 (2); dorsal, 0, 0, 3, 1, 1; claws 2. Ventral spines of penult legs, 0, 1, 3, 3, 2; dorsal, 0, 0, 3, 2, 2; claws 3. None of the coxae armed. Ventral spines of first legs, 0, 0, 0, 0, 0; of second, 0, 0, 0, 0, 1. Anal legs of male with no definite ridge or lobe above at distal end. Gonopods of female and thin basal spines normal.

Length 14–15 mm.

### **Mayobius schmidtii** sp. nov.

*Type* from Volcan Tajumulco, San Marcos, Guatemala. A male. Collected February 18, 1934, by K. P. Schmidt.

<sup>1</sup> Named for Mr. Leon Mandel, of Chicago, patron of the Mandel Guatemala Expedition.

*Description.*—Dorsum brown, the posterior tergites somewhat more reddish. Antennae paler distally.

Antennae short, composed of 28 segments. Ocelli in three series; e.g., 1+1, 3, 3; the single ocellus well separated; the ocellus in dorsal position very large, exceeding the single ocellus. Prosternal teeth 2+2, the ectal spine setiform, inserted on a low truncate elevation somewhat like that of *V. cobulcanus*. Posterior angles of ninth, eleventh and thirteenth dorsal plates produced. Coxal pores circular; 2, 2, 2, 2. Ventral spines of anal legs, 0, 0 (or 1 abortive), 3, 2, 0; dorsal, 0, 0, 2, 1, 0; claws 2. Ventral spines of penult legs, 0, 1 (abortive), 3, 2, 0; dorsal, 0, 0, 2, 1, 1; claws 2. None of coxae armed either dorsally or laterally. None of joints of first legs armed ventrally. Anal legs of male without special lobes or modification.

Length about 7.5 mm.

**Mayobius tajumulcensis** sp. nov.

*Type* from Volcan Tajumulco, San Marcos, Guatemala. A male. Collected February 22, 1934, by K. P. Schmidt.

*Paratypes.*—Two specimens from the type locality and three from Santa Elena, near Tecpan, Chimaltenango. Collected January 26, 1934, by F. J. W. Schmidt.

*Description.*—Of the usual brownish color, with sometimes a tendency to chestnut especially on posterior segments. Antennae unusually short, composed of 32–34 short and very short segments. Ocelli in three series; e.g., 1+3, 4, 3; single ocellus large, somewhat lunate in shape with concavity cephalad; first ocellus of top and of bottom rows larger than other seriate ocelli. Prosternal teeth 2+2, small; ectal seta spiniform but rather slender, less robust than in *V. vulcani*. Dorsal plates as usual; the corners of the seventh more produced than in *chichivacus* and *mandeli*. Coxal pores, e.g., 4, 4, 5, 4.

Ventral spines of anal legs, 0, 1, 2, 1, 0; dorsal, 0, 0, 3, 1, 0; claws double. Ventral spines of penult legs, 0, 1, 3, 3, 1; dorsal, 0, 0, 3, 1, 1; claws double. None of posterior coxae armed. Ventral spines of first legs, 0, 0, 0, 0, 1. Anal legs of male with fifth joint not ridged or lobed, normal. Gonopods of female with claw and spines normal.

Length about 13 mm.

**Sotimpilus octodentus** sp. nov.

*Type* from Santa Elena, near Tecpan, Chimaltenango, Guatemala. Altitude 9,500 feet. Female. Collected January 26, 1934, by F. J. W. Schmidt.

*Paratypes*.---Two females. One from the type locality, collected February 7, 1934, and one from Volcan Tajumulco, collected February 13, 1934, by K. P. Schmidt.

*Description*.---Dark brown, in part of chestnut cast; with a median dorsal dark stripe more or less in evidence; antennae and posterior legs paler distally. Antennae moderately long, composed in types of 45 to 50 segments. Ocelli in three series; e.g., 1+3, 3, 2; single ocellus large and well separated; posterior ocellus of top series next in size. Prosternal teeth 4+4, black; ectal seta of moderate stoutness, slenderly subspiniform. Posterior angles of ninth, eleventh and thirteenth dorsal plates produced, and posterior corners of seventh also with caudal margin long and running a little obliquely caudad of ectal. Coxal pores mostly transverse; arranged, e.g., 6, 6, 6, 6.

Ventral spines of anal legs, 0, 1, 3, 3, 2; dorsal, 1, 0, 3, 2, 0; claws 2. Ventral spines of penult legs, 0, 1, 3, 3, 2; dorsal, 1, 0, 3, 2, 2; claws 2. Last four pairs of coxae dorsally armed. None laterally armed. Ventral spines of first legs, 0, 0, 1, 2, 2. Gonopods of female with claws entire; basal spines 2+2, acuminate from base distad.

Length about 22 mm.

*Remarks*.---This species seems to differ from *S. decodontus* Pocock in lacking lateral spines on the posterior coxae and in having the ventral spines of the first legs 0, 0, 1, 2, 2 instead of 0, 0, 0, 1, 1, etc.

### Family Lithobiidae

#### *Lithobius forficatus* Linnaeus

*Scolopendra forficata* Linnaeus, Syst. Nat., 10th ed., 1, p. 638, 1758.

*Lithobius forficatus* Leach, Edinb. Encyc., 7, p. 458, 1815.

New York: North Rose, 1, September 22, 1928 (A. C. Weed).

Illinois: Chicago (Woodlawn), 8, September 4, 1908 (H. Munzner); Chicago (Jackson Park), 14, 1897 (E. B. Chope); Hickory Creek, near New Lenox, Will County, 1, October 5, 1940 (W. J. Beecher); Glenview, 1, October 13, 1940 (W. J. Beecher); Willow Springs, Cook County, 1, September 28, 1906 (E. B. Chope); Plano, Kendall County, 6, May 3, 1942 (H. S. Dybas).

England: 1, October 23, 1936 (Henry Field).

#### *Enarthrobium* Chamberlin

*Enarthrobium* Chamberlin, Proc. Biol. Soc. Wash., 39, p. 9, 1926.

This genus has heretofore been known only from the type species, *E. bullifer* Chamberlin, from South Carolina. Four new species of the genus are here added, the types of all of which were collected recently in the Great Smoky Mountains of Tennessee by Henry S. Dybas. The five species now constituting the genus may be distinguished by means of the following key.

#### KEY TO THE SPECIES OF ENARTHROBIUS

- 1(6). Posterior angles of only ninth, eleventh and thirteenth dorsal plates produced (Subgenus *Enarthrobius*, sens. str.) ..... 2
- 2(3). None of the coxae laterally armed; length near 18 mm.  
*E. bullifer* Chamberlin
- 3(2). One or more of posterior pairs of coxae laterally armed; length not exceeding 10 mm. .... 4
- 4(5). Ventral spines of penult legs, 0, 1, 3, 3, 1; of anal legs, 0, 1, 3, 2, 0; length 6.5-7 mm. .... *E. litus* sp. nov.
- 5(4). Ventral spines of penult legs, 0, 1, 3, 3, 2; of anal legs, 0, 1, 3, 2, 1 (male); length near 9 mm. .... *E. fumans* sp. nov.
- 6(1). Posterior angles of seventh, or of both sixth and seventh, dorsal plates also produced (Subgenus *Capnobioides*) ..... 7
- 7(8). Posterior angles of sixth dorsal plate not produced; claw of anal legs single.  
*E. dybasi* sp. nov.
- 8(7). Posterior angles of sixth dorsal plate produced; claw of anal legs double.  
*E. covenus* sp. nov.

#### *Enarthrobius litus* sp. nov.

*Type* from Greenbrier Cove, Great Smoky Mountains National Park, Tennessee. A male. Collected June 14-19, 1942, by H. S. Dybas.

*Paratype*. A male, taken with the type.

*Description*.-- A much smaller form than *E. bullifer*, the genotype. Dorsum, antennae and posterior legs brown, the other legs a lighter brown. Antennae moderate, composed typically of thirty segments. Ocelli few, in a narrow patch; e.g., 1+3, 2. Prosternal teeth 2+2, uniform in size, the margin slanting directly back from immediately outside of outer tooth. Coxal pores small, 2, 3, 3.

Ventral spines of penult legs, 0, 1, 3, 3, 1; dorsal, 0, 0, 3, 1, 1; claws 2. Ventral spines of anal legs, 0, 1, 3, 2, 0; dorsal, 1, 0, 3, 1, 0; claw single. Last pair of coxae laterally armed. In the anal legs of the male the fourth segment is crassate, thickening distad somewhat clavately; the dorsal lobe at caudal end is low, flat, and wide, its slightly projecting caudal edge seen from above evenly convex. Fifth joint abruptly thinner than the fourth.

Length 6.5-7 mm.



**Enarthrobium fumans** sp. nov.

*Type* from Greenbrier Cove, Great Smoky Mountains National Park. A male. Collected June 14 19, by H. S. Dybas.

*Allotype*.—Taken with the type.

*Description*.—A smaller, somewhat darker species than *E. dybasi*. Antennae composed of thirty-five segments. Ocelli, e.g., 1+4, 4, 3, fewer than in the genotype. Prosternal teeth 2+2 as in *dybasi* but in the latter the prosternal margin ectad of the outer tooth forming a widely rounded shoulder, whereas in the present species it runs directly ectocaudad in a nearly straight line without forming a shoulder. Mesal tooth relatively larger in *dybasi* than in *fumans*. Posterior angles of only ninth, eleventh and thirteenth dorsal plates produced. Coxal pores 4, 4, 4, 3.

Ventral spines of first legs, 0, 0, 1, 2, 1; of penult, 0, 1, 3, 3, 2, with 3 claws, of which one is spine-like; of anal legs, 0, 1, 3, 2, 1 (male), the claw unarmed. Last pair of coxae armed dorsally, the last two pairs laterally. Gonopods of female with claw bipartite: basal spines 2+2. In the male the fourth joint of the anal legs broadly furrowed above with outer rim less elevated than in *dybasi*, extending in a transverse rim projecting at caudal end.

Length about 9 mm.

**Capnobius** subgen. nov.

Posterior angles of seventh or of both sixth and seventh dorsal plates produced, as well as those of ninth, eleventh, and thirteenth.

Type *Enarthrobium* (*Capnobius*) *covenus* sp. nov.

**Enarthrobium** (*Capnobius*) *covenus* sp. nov.

*Type* from Greenbrier Cove, Great Smoky Mountains National Park, Tennessee. A female. Collected June 14 19, 1942, by H. S. Dybas.

*Paratype*.—A female, taken with the type.

*Description*.—Readily distinguished from *E. bullifer*, the genotype, in having the posterior angles of the sixth and seventh, as well as those of the ninth, eleventh, and thirteenth dorsal plates produced. Differing also from the other three species here described in having the angles of the sixth tergite produced. Dorsum brown, with head and antennae and posterior tergites and legs darker, more chestnut. Antennae short, composed of 29-32 segments in the types.

Ocelli in three series. Prosternal teeth 2+2. Coxal pores circular; e.g., 4, 4, 4, 3.

Ventral spines of penult legs, 0, 1, 3, 3, 2; dorsal, 1, 0, 3, 1, 1; claws 2. Ventral spines of anal legs, 0, 1, 3, 2, 1; dorsal, 1, 0, 3, 1, 1 (0); claws 2. Last coxae laterally armed.

Length 10 mm.

*Remarks.*—The two females upon which the present species is based are unfortunately of the *immaturus* stage but seem sufficiently distinct to warrant description and naming. In these specimens the claw of the gonopods is still entire and the basal spines but 1+1.

### **Enarthrobium (Capnobius) dybasi sp. nov.**

*Type* from Gatlinburg, Great Smoky Mountains National Park, Tennessee. A male. Collected June 13–14, 1942, by H. S. Dybas.

*Description.*—Dorsum brown, with head and antennae darker, the latter paler distally. Antennae of moderate length, consisting in the holotype of thirty-seven segments. Ocelli in four series; e.g., 1+4, 5, 5, 2, a total of 17. The single ocellus contiguous, not enlarged. Prosternal teeth 2+2, with the inner one on each side larger and more salient than the outer. Posterior angles of seventh, ninth, eleventh, and fifteenth dorsal plates produced. Coxal pores circular, 4, 5, 5, 4.

Ventral spines of first legs, 0, 0, 1, 2, 1. Ventral spines of anal legs, 0, 1, 3, 3, 1, the claw single. Last three pairs of coxae dorsally armed, the last two laterally also. Fourth segment of anal legs of male long; dorsal ridge along entire length, its caudal portion higher and running oblique to axis, inside view appearing much like keel on a *Nadabius*.

Length about 12 mm.

### **Neolithobius transmarinus Koch**

*Lithobius transmarinus* Koch, Myr. Gatt. Lithobius, p. 33, 1862.

*Lithobius (Neolithobius) transmarinus* Stuxberg, Ofvers. Kungl. Vet.-Akad. Forh., 32, No. 3, p. 26, 1875.

Texas: San Marcos, Hays County, 2, April 22, 1941 (K. P. Schmidt); southwest of Henderson, Rush County, 1, April 20, 1941 (K. P. Schmidt); Saltillo, Hopkins County, 1, April 5, 1937 (K. P. Schmidt).

### **Neolithobius suprenans Chamberlin**

*Neolithobius suprenans* Chamberlin, Bull. Mus. Comp. Zool., 57, p. 500, 1925.

Arkansas: Nineteen miles south of Pocahontas, 1, Randolph County, April, 1941 (J. M. Schmidt).

**Neolithobius arkansensis** sp. nov.

*Type* from Rich Mountain, Polk County, Arkansas. A male. Collected March 21, 1938, by K. P. Schmidt.

*Paratypes*.—Ten specimens, collected by K. P. Schmidt: From Rich Mountain, Polk County, March 21 22, 1938, three specimens; eleven miles west of Hot Springs, Garland County, March 21, 1938, two specimens; Mount Magazine, Logan County, 2,500 feet, March 24, 1938, one male; seven miles north of Arkadelphia, Clark County, April 4, 1937, three specimens; two miles east of Ben Lomond, Sevier County, April 16, 1941, one male.

*Description*.—Dorsum brown, with the head and antennae of a somewhat chestnut cast. Legs light, somewhat yellowish brown. Antennae reaching to ninth tergite or nearly so; composed typically of 42–45 segments. Ocelli typically in seven longitudinal series forming an elliptical patch; e.g., 1+4, 6, 8, 7, 6, 6, 4. Prosternal teeth mostly 8+8 to 10+10. Coxal pores lying in a deep groove, transversely elongate; arrangement, e.g., 9, 9, 9, 8.

Ventral spines of anal legs, 0, 1, 3, 3, 2; dorsal, 1, 0, 3, 1, 0; claw single. Ventral spines of penult legs, 0, 1, 3, 3, 2; dorsal, 1, 0, 3, 1, 0; claw with a minute accessory claw on anterior side. Tibia of all legs from thirteenth forward, usually to and including the second, with three ventral spines at distal end. Gonopods of female as in *N. latzei*. Length up to 22 mm.

*Remarks*. Closely related to *N. latzei* Meinert, occurring in Virginia and North Carolina, but with antennae longer and composed of more numerous segments: 42 45 as compared to 31 34. Coxal pores typically also more numerous.

**Neolithobius tyrannicus** Bollman

*Lithobius* (*Neolithobius*) *tyrannicus* Bollman, Proc. U. S. Nat. Mus., 10, p. 626, 1887.

*Lithobius* (*Neolithobius*) *tyrannicus* Bollman, Bull. U. S. Nat. Mus., 46, p. 43, 1893.

Indiana: Annapolis, "Devil's Den," Parke County, 1, October 20, 1941 (R. L. Wenzel); Dune Acres, Porter County, 2, March 22 and July 30, 1941 (H. S. Dybas).

**Neolithobius voracior** Chamberlin

*Lithobius voracior* Chamberlin, Ann. Ent. Soc. Amer., 5, p. 150, 1912.

*Neolithobius voracior* Chamberlin, Bull. Mus. Comp. Zool., 57, p. 492, 1925.

Missouri: Libertyville, St. Francois County, 2, April 2, 1937 (K. P. Schmidt).

Illinois: Bottom land of Silver Creek, west of Kaufman, Madison County, 3; Edgebrook, Cook County, 1, November 15, 1917 (Emil Liljeblad).

**Neolithobius aztecus** Humbert and Saussure

*Lithobius aztecus* Humbert and Saussure, Rev. Mag. Zool., (2), 21, p. 156, 1869.

Mexico: Vera Cruz, Las Vigas, a male and female, June 30, 1941 (H. S. Dybas).

**Gonibius rex** Bollman

*Lithobius rex* Bollman, Proc. U. S. Nat. Mus., 11, p. 350, 1888.

*Gonibius rex* Chamberlin, Bull. Mus. Comp. Zool., 57, p. 447, 1925.

Tennessee: Great Smoky Mountains National Park, Gatlinburg, 1 male, June 13–19, 1942, and Greenbrier Cove, 1 male, June 14–19, 1942 (H. S. Dybas).

This species was previously known only from the female. It may be here noted that the anal legs of the male are without special secondary modifications.

**Pokabius bilabiatatus** Wood

*Lithobius bilabiatatus* Wood, Proc. Acad. Nat. Sci. Phila., 1867, p. 130, 1867.

*Pokabius bilabiatatus* Chamberlin, Bull. Mus. Comp. Zool., 57, p. 347, 1922.

Illinois: Near River Forest, along the Des Plaines River, Cook County, 1, November 26, 1922 (A. C. Weed).

**Pokabius disantus** Chamberlin

*Pokabius disantus* Chamberlin, Bull. Mus. Comp. Zool., 57, p. 354, pl. 9, fig. 3, 1922.

California: Los Angeles, 10, 1936–38 (Gordon Grant).

**Nadabius iowensis** Meinert

*Lithobius iowensis* Meinert, Proc. Amer. Phil. Soc., 23, p. 177, 1886.

*Nadabius iowensis* Chamberlin, Bull. Mus. Comp. Zool., 57, p. 62, 1913.

Illinois: Monee, Will County, 1, March 24, 1908 (Henry Ramstadt).

**Nadabius eremites** sp. nov.

*Type* from Greenbrier Cove, Great Smoky Mountains National Park, Tennessee. A male. Collected June 13 19, 1942, by H. S. Dybas.

*Description*.—Dorsum and basal part of legs a yellow-brown, with antennae and distal part of legs a brighter, lemon yellow. Antennae short; last segment long, nearly equaling the three preceding segments taken together. Ocelli in a narrow, elongate patch; 1+4, 4, 3, those of bottom row very small. Prosternal teeth 2+2, the inner tooth on each side larger than the outer. Coxal process 3 (2), 4, 4, 3.

Ventral spines of first legs, 0, 0, 1, 2, 1. Ventral spines of penult legs, 0, 1, 3, 2, 1; dorsal, 1, 0, 2, 1, 0; claws 3. Ventral spines of anal legs, 0, 1, 3, 1, 0; dorsal, 1, 0, 2, 0, 0; claw single. Last four pairs of coxae dorsally armed, none laterally. Tibia of anal legs of male with the usual setose lobe at distal end, this located at distomesal corner.

Length 9 mm.

*Remarks*.—Readily distinguished from all previously known species in the peculiar spine formulae of the last two pairs of legs.

**Nadabius ameles** sp. nov.

*Type* from Dune Acres (=Mineral Springs), Porter County, Indiana. A male. Collected April 18, 1942, by H. S. Dybas.

*Description*. A species near to *N. eigenmanni* Bollman of Washington and British Columbia in having the anal legs with the claw single and the prosternal teeth 2+2. It is a somewhat larger form, differing from *eigenmanni* in having the ventral spines of anal legs 0, 1, 3, 3, 1 instead of 0, 1, 3, 3, 0 as well as in the details of the secondary character of these legs in the male. In these the fifth joint has a longitudinal furrow above, this deepest and widest at distal end where it is limited by the characteristic low lobe; mesal face of fourth, fifth and sixth joints complanate and densely setose, the setae at distal end of fifth joint not especially long and not curved caudad at their tips as in *eigenmanni*; fourth joint not noticeably furrowed above.

Length about 13 mm.

**Nothembius nampus** Chamberlin

*Nothembius nampus* Chamberlin, Bull. Mus. Comp. Zool., 57, p. 194, pl. 8, fig. 4, pl. 9, 1916.

California: Los Angeles, 2, March 1, 1936 (Gordon Grant).

**Sozibius providens** Bollman

*Lithobius providens* Bollman, Amer. Nat., 21, p. 81, 1887.

*Sozibius providens* Chamberlin, Bull. Mus. Comp. Zool., 57, p. 268, 1922.

Tennessee: Great Smoky Mountains National Park, Greenbrier Cove, a male and female, June 14 19, 1942 (H. S. Dybas).

**Nampabius virginienensis** Chamberlin

*Nampabius virginienensis* Chamberlin, Bull. Mus. Comp. Zool., 57, p. 45, 1913.

Tennessee: Great Smoky Mountains National Park, Greenbrier Cove, 1, June 13 19, 1942 (H. S. Dybas).

**Sigibius urbanus** sp. nov.

*Type* from Chicago. A female. Collected March 20, 1942, by Henry S. Dybas.

*Description.* Separated from other known species, excepting *S. enans*, in having the ventral spines of the anal legs 0, 1, 3, 1, 0 instead of 0, 1, 1, 1, 0 or none. Dorsal spines of anal legs, 0, 0, 2, 0, 0; claws 2. Ventral spines of penult legs, 0, 1, 3, 3, 1; dorsal, 0, 0, 2, 1, 0; claws 2. Differing from *enans* in having the ventral spines of the first and second legs 0, 0, 0, 1, instead of 0, 0, 0, 1, 1 and 0, 0, 0, 2, 1 respectively. Articles of antennae 29 or 30, mostly very short and not always distinct, this number being the highest known for the genus, most species having 25 or 26. Claw of female genital forceps pale, tripartite; basal spines 2+2.

Length 8 mm.

**Family Ethopodidae****Bothropolys multidentatus** Newport

*Lithobius multidentatus* Newport, Trans. Linn. Soc. Lond., 19, p. 365, 1845.

*Bothropolys multidentatus* Wood, Trans. Amer. Phil. Soc., (n.s.), 13, p. 152, 1865.

Illinois: Plano, Kendall County, 1, May 2, 1942 (H. S. Dybas).

Missouri: Libertyville, St. Francois County, 1, April 2, 1937 (K. P. Schmidt).

Tennessee: Townsend, Blount County, 1, June 16, 1942 (H. S. Dybas).

Indiana: Annapolis, "Devil's Den," Parke County, 1, October 20, 1940 (R. L. Wenzel); Smith Woods, northeast of Springville, La Porte County, 1 (R. L. Wenzel); Dune Acres, Porter County, 17, March 22 and April 19, 1942 (H. S. Dybas).

Illinois: Aurora, Kane County, 1, April, 1940 (H. S. Dybas); Monee, Will County, 8, March 24, 1908 (Henry Ramstadt).

## Order Scutigerida

### Family Scutigeridae

#### *Scutigera coleoptrata* Linnaeus

*Scolopendra coleoptrata* Linnaeus, Syst. Nat., 10th ed., 1, p. 537, 1758.

*Scutigera coleoptrata* Lamarck, Syst. Anim. Sans. Vert., p. 182, 1801.

*Scutigera coleoptrata* Chamberlin, Ann. Ent. Soc. Amer., 13, p. 283, 1920.

*Selista forceps* Rafinesque, Ann. Nat., 1820, p. 7, 1820.

*Cernatia forceps* Wood, Trans. Amer. Phil. Soc., 13, p. 145, pl. 3, figs. 1, 1a, 1865.

Tennessee: Great Smoky Mountains National Park, Greenbrier Cove, 1, June 19, 1942 (H. S. Dybas).

Maryland: Eight miles south of Frederick, 1, August 23, 1941 (Henry Field).

Illinois: Elmwood Park, Cook County, 1, June 15, 1931 (Charles Lewis); Chicago, 1, September 6, 1902 (L. V. Kenkel), 1, October 31, 1905 (H. Stebbins).

California: Los Angeles, 1, August, 1937 (Gordon Grant).

Bermuda: St. David's Island, 1, October 20, 1905 (Joe Millet).

#### *Scutigera lincei* Wood

*Cernatia lincei* Wood, Proc. Acad. Nat. Sci. Phila., 1867, p. 42, 1867.

*Scutigera mexicana* Saussure and Humbert, Miss. Sci. Mex., Myriop., 5, fig. 3, 1872.

*Scutigera occidentalis* Meinert, Vid. Medd. Nat. Foren., 1886, p. 105, 1886.

*Scutigera lincei* Pocock, Biol. Cent.-Amer., Chilopoda, p. 1, pl. 1, figs. 1, 1a, 1b, 1895.

Guatemala: Samac, Alta Verapaz, 1, March 20, 1934 (K. P. Schmidt).

#### *Scutigera chichivaca* sp. nov. Pl. 15, fig. 14.

*Type* from Chichivac near Tecpan, Chimaltenango, Guatemala. Collected February 4-7, 1934, by F. J. W. Schmidt.

*Description.* Dorsum green, with a somewhat paler median longitudinal stripe which does not contrast sharply. Legs light green, with tarsi light brown. Antennae also brown. Segments of antennae very short, much broader than long. First division consisting of 35 segments, the second of about 58. The stoma-bearing tergites posteriorly incurved at middle, the stoma even with the middle part of margin or but slightly projecting. Stoma saddles relatively wide, but little elevated. Stoma short, on posterior slope of saddles. Last tergite with posterior margin slightly incurved mesally (fig. 14). Surface of all tergites bearing the usual slender spiniform setae unaccompanied by hairs, these numerous on margins, more sparse on general surface.

First division of tarsus III composed of 9 segments, the second of 20. First tarsus of tenth legs composed of 6 segments, the second of 21. First tarsus of legs unspined distally. Gonopodal processes in male short, subcylindrical or slenderly subconical, widely separated.

Length 11 mm.

*Remarks.* Readily distinguishable from the widespread *S. lincei* Wood in lacking yellow longitudinal bands on dorsum, and from the Costa Rican *S. nubila* Chamberlin also in its conspicuously different color as well as in the different number of segments in first division of antennae and in both divisions of tarsi, etc.

**Scutigera buda** sp. nov. Pl. 17, fig. 25.

*Type* from ten miles north of Buda, Hays County, Texas. A female. Collected April 23, 1941, by K. P. Schmidt.

*Paratypes*, consisting of two females and an immature specimen, taken with the type.

*Description.* Dorsum yellowish or yellow-brown with an obscure lighter mid-dorsal stripe which shows best on the saddles but may be obliterated in front of saddle on each segment. The legs are yellow, without markings, excepting the posterior pairs, which are darker, greenish, except the tarsi, which are yellow or distally of light ferruginous tinge. While superficially resembling *S. homa* of Arizona, differing in details of color pattern as above described and in structural details such as in having first division of antennae normally consisting of only 54 segments as against 80 in *homa*. Second division of antennae consisting of about 95 segments. Tergites excised behind as usual, with stoma short and moderately projecting into the excision. Setae numerous and uniform. Last tergite with caudal margin blunt or slightly very obtusely indented. First tarsus I con-



sisting of 13 segments, the second of 33. First tarsus II of 14 segments, the second of 22. First tarsus III of 12 segments, the second of 22. First tarsus IV of 10 segments, the second of 27. First tarsus V of 8 segments, the second of 27. First tarsus VIII of 7 segments, the second of 27. Gonopods of female as shown in fig. 25. The claws relatively larger than in *S. homa*.

Length 15 mm.

**Scutigera poicila** sp. nov. Pl. 17, fig. 26.

*Type* from Peñuela, Vera Cruz, Mexico. A female. Collected July 17, 1941, by H. S. Dybas.

*Description*.—Dorsum with a broad dark olive band along each side and a narrower one of same color along mid-dorsum, the median band extending in a narrower tongue on stoma saddle to anterior edge of stoma, with lateral areas of stoma saddle salmon-colored. The narrow white stripe on each side separating the dark stripes and extending also upon the head. Antenna olive. Legs in general also olive but femur pale over dorsal surface and in a subdistal annular, the patella with a lighter annular at middle and base, and tibia with submedian annular and one at distal end. Tarsi tending to be light ferruginous distally. Articles of antennae very short; first division in the type consisting of 65 segments, the second of about 157. Tergites with margin incurved at middle behind with stoma but slightly projecting. Setae of tergites normal. Last tergite with caudal margin forming a slight obtuse angle at middle or appearing weakly convex. First tarsus I composed of 14 segments, the second of 30. First tarsus II consisting of 12 segments, the second of 29. First tarsus III composed of 11 segments, the second of 28. First tarsus VII of 8 segments, the second of 25; spines at end of first tarsus. Gonopods of female diverging, with intervals between them broad as shown in fig. 26.

Length about 13 mm.

*Remarks*.—A somewhat smaller form than *S. tancitarona*. It differs obviously in the divergent female gonopods and in the color pattern of dorsum, e.g. the interrupted median stripe and the salmon-colored stoma saddles.

**Parascutigera lembehna** sp. nov. Pl. 17, fig. 27.

*Type* from Lembah Island, in the northern Celebes. A female. Collected June 22, 1929, by K. P. Schmidt.

*Description.* A larger form than *P. dahli*, the genotype, from which also it differs conspicuously in color and in structural details, noted below. The dorsum of the preserved type is light brown or yellowish, with a broken dark band along each border with spots of same color or marbled, on adjacent part of sides, a narrow geminate mid-dorsal dark band less prominent. Legs yellow with dark annuli of which there is one at distal end of femur, two on patella of which the more distal is broader, one very broad one of greenish color on tibia and 2 or 3 broad green ones on tarsus. Antennae ferruginous yellow, uniform. The first division of antennae consisting of 148 segments, all of which, excepting the basal and terminal ones, are very short in relation to breadth; second division embracing 200 segments. Antennae without spines. Tergites excised behind, the excision rounded at bottom. Stoma short, not projecting behind into excision. Last pregenital tergite caudally rounded. First division of tarsus I composed of 11 segments, the second of 33. First tarsus II of 10 segments, the second of 32. First tarsus III of 10 segments, the second of 31. First tarsus IV of 8 segments, the second of 30. First tarsus V of 7 segments, the second of 28. First tarsus VI of 6 segments, the second of 27. First tarsus VII of 6 segments, the second of 26. Basal divisions of the female gonopods narrowly separated and parallel, the claws relatively long. See further figures.

Length about 20 mm.

***Thereuopoda sandakana* sp. nov. Pl. 15, figs. 15, 16.**

*Type* from Sandakan, British North Borneo, at "Mile 8." Collected July 10, 1929, by Karl P. Schmidt (Crane Pacific Expedition).

*Description.* Dorsum brown with a median longitudinal yellow stripe as wide as the stoma saddles; the latter dark brown over anterior two-thirds or so, yellow behind, the brown constituting interruptions in the yellow stripe. Dorsal surface of head yellow. Legs yellow, not annulate. Antennae lost excepting basal portion; segments present moderate in length, a little wider than long. First tarsus I composed of 22 segments. First tarsus IV composed of 15 segments, the second of 47. First tarsus X composed of 9 segments, the second of 40. First tarsus XII composed of 11 segments, the second of 41. Stoma-bearing tergites with middle portion of posterior margin straight, the stoma not exceeding it; one or more posterior segments, a little incurved. Last tergite of form shown in fig. 15. Tergites with marginal setae close-set, each accompanied

by a finer seta or hair; setae on lateral areas of plates rather sparse, denser over middle region and especially on stoma saddles.

Length 30 mm.

***Allothoreua manila* sp. nov.** Pl. 15, figs. 17, 18.

*Type* from Manila, Philippine Islands. Female. Collected, 1931, by J. W. Willey.

*Description*.—Dorsum of a somewhat uneven brown color; lighter over stoma saddles and immediately in front of same in a stripe, narrower than saddles, which does not extend over anterior region of plate. Legs paler, not definitely annulate, or sometimes showing a vague lighter ring at middle of front joint and at each end of same. Segments of proximal part of antennae mostly somewhat wider than long, with segments which are obviously longer than wide interpolated at intervals. First division composed of 111 segments. Tergites with middle third or so of caudal portion conspicuously protruding, the caudal margin of produced portion nearly straight or widely, slightly incurved. Stoma saddles strongly elevated, adjacent caudal side areas less strongly so. Marginal setae close-set; those of lateral areas of plate sparse and in part weak. Those over saddles and middle region denser. Last tergite with caudal margin obtusely, not deeply, notched (fig. 17). First tarsus I composed of 20 segments, the second of 56. First tarsus IX composed of 11 segments, the second of 37. Female genital forceps and adjacent pairs of caudal end as figured (fig. 18).

Length about 37 mm.

## PLATES

PLATE 13

*Pectiniunguis fieldi* sp. nov.

FIG. 1. End of mandible.

FIG. 2. Labrum.

*Meistocephalus consocius* sp. nov.

FIG. 3. Labrum.

*Meistocephalus manokwari* sp. nov.

FIG. 4. Cephalic plate, dorsal view.

FIG. 5. Labrum.

*Meistocephalus tsenopus* sp. nov.

FIG. 6. Cephalic plate.

FIG. 7. Labrum.

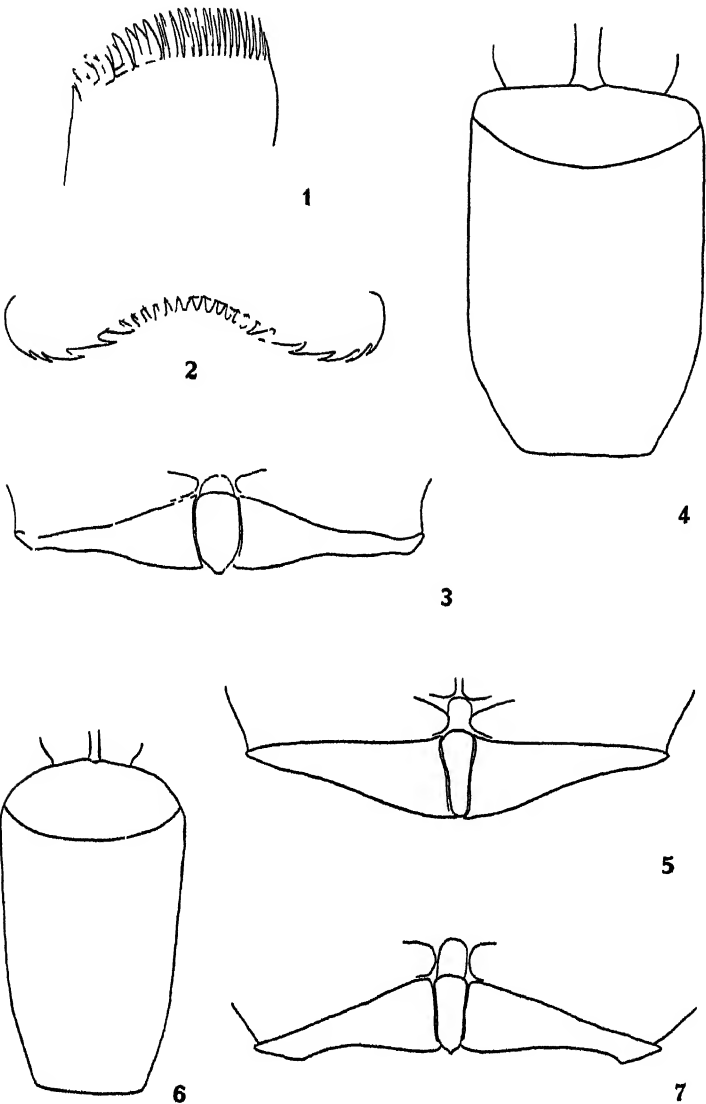


PLATE 14

*Dasyplyx hybrides* sp. nov.

FIG. 8. Cephalic plate.

FIG. 9. Labrum.

*Arenophilus rugans* sp. nov.

FIG. 10. Distal end of anal leg

*Garrina tecpanus* sp. nov.

FIG. 11. Cephalic plate, dorsal view.

*Suturodes gerhardi* sp. nov.

FIG. 12. Caudal end, dorsal view.

*Suturodes schmidtii* sp. nov.

FIG. 13. Caudal end, dorsal view

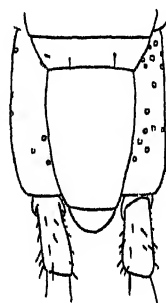
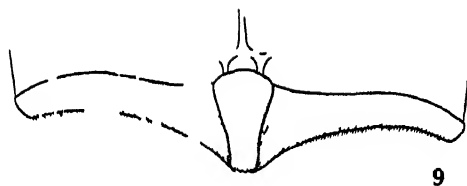
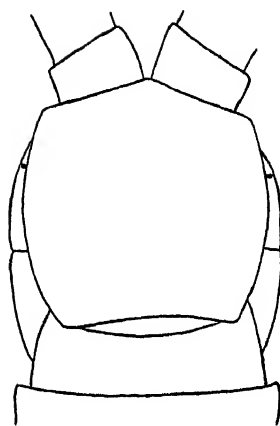
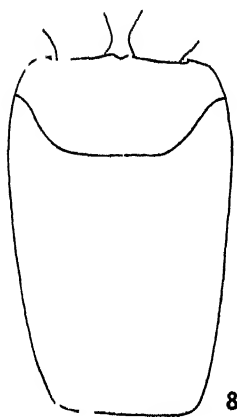




PLATE 15

*Scutigera chichivaca* sp. nov.

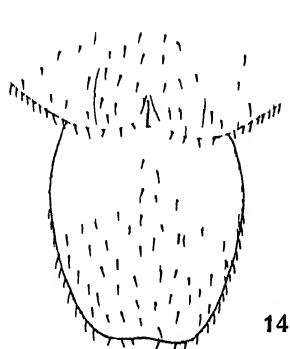
FIG. 14 Last tergite, dorsal view

*Thereuopoda sandakana* sp. nov.

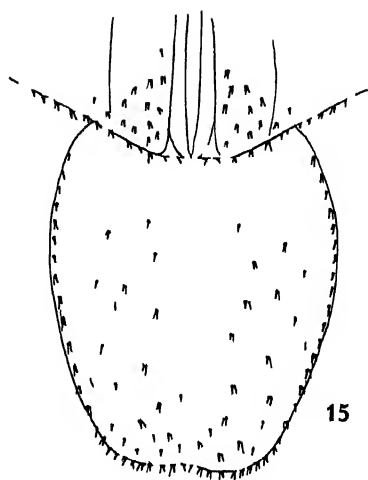
FIG. 15. Last tergite, dorsal view      FIG. 16 Genital forceps of female

*Allothereua manila* sp. nov.

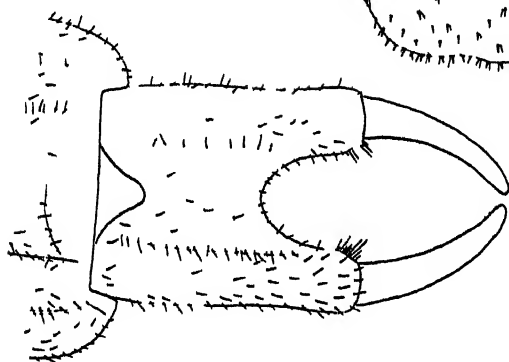
FIG. 17. Last tergite, dorsal view.      FIG. 18 Genital forceps of female



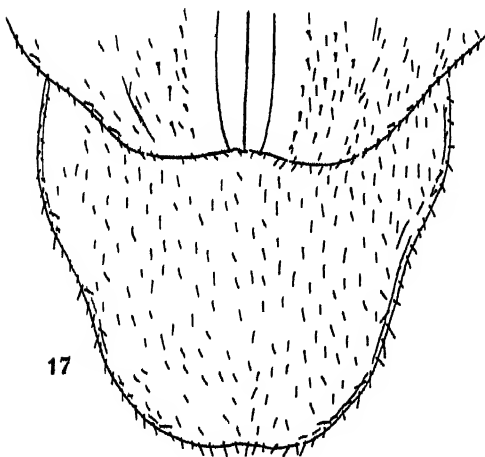
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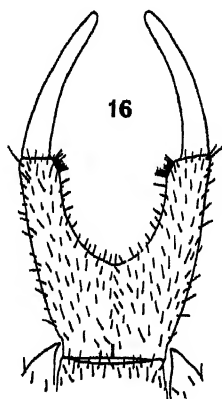
15



18



17



16

PLATE 16

*Polycricus cruzanus* sp. nov.

FIG. 19. Caudal end, dorsal view, in outline.

*Polycricus jacalanus* sp. nov.

FIG. 20. Caudal end, dorsal view.

*Polycricus verus* sp. nov.

FIG. 21. Caudal end, dorsal view.

*Polycricus brachyceph* sp. nov.

FIG. 22. Head and prehensors, dorsal view.

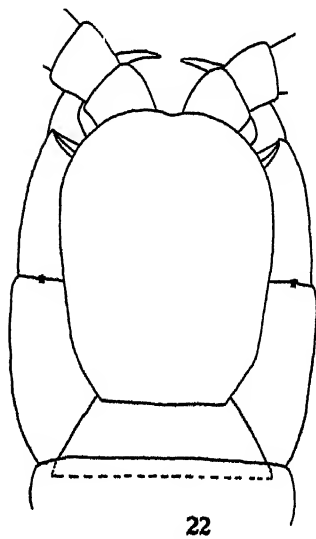
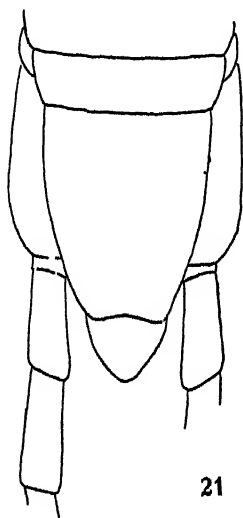
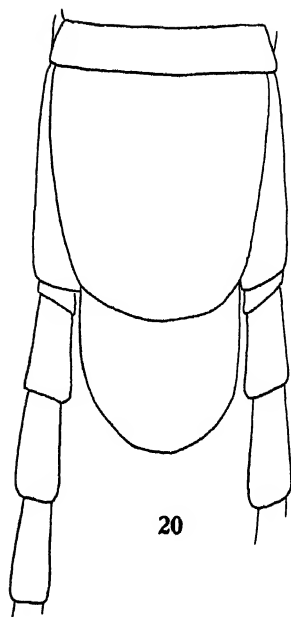
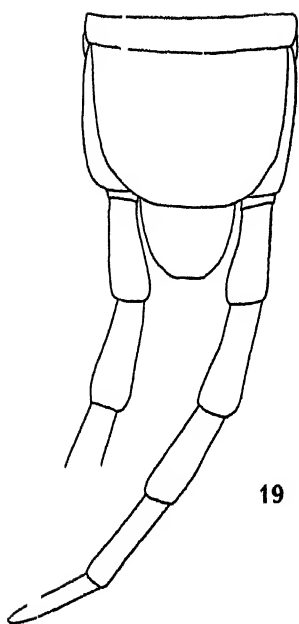


PLATE 17

*Lamyctes leon* sp. nov.

FIG. 23. Last five segments of right anal leg, ectal view.

*Gospina dybasi* sp. nov.

FIG. 24. Distal end of anal leg.

*Scutigera buda* sp. nov.

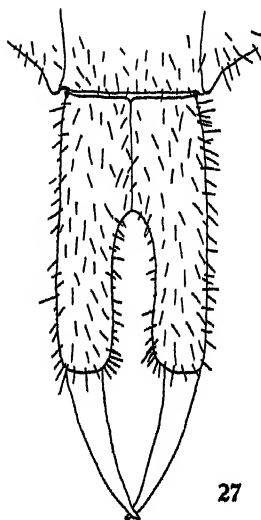
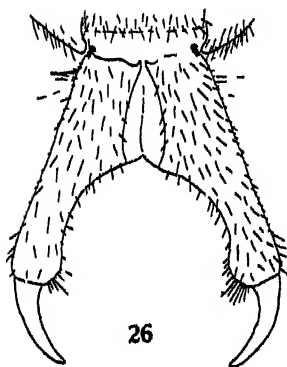
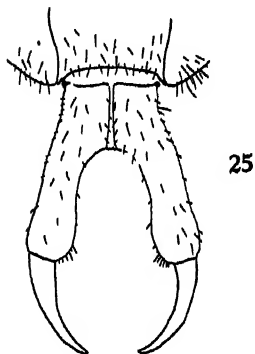
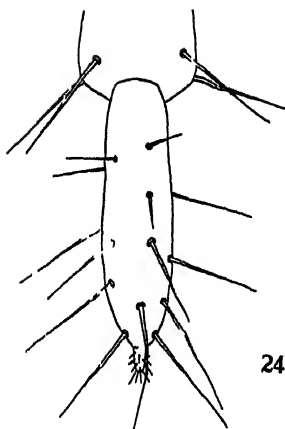
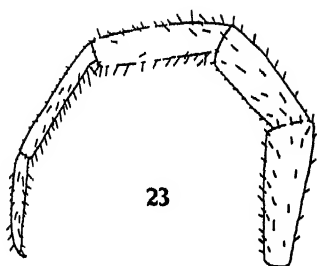
FIG. 25. Gonopods of female.

*Scutigera porcila* sp. nov.

FIG. 26. Gonopods of female.

*Parascutigera lembekna* sp. nov.

FIG. 27. Gonopods of female.





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